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PROGRAM OF WORK
OF THE
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PROGRAM OF WORK OF THE UNITED STATES DEPARTMENT OF AGRICULTURE FOR THE FISCAL YEAR 1916.

OFFICE OF THE SECRETARY.

SECRETARY'S OFFICE.

Secretary's Office:

Object.—The Secretary of Agriculture is charged with the work of promoting agriculture in its broadest sense. He exercises general supervision and control over the affairs of the department and formulates and establishes the general policies to be pursued by its various branches.

Cooperation.—Congress, other departments, the respective States, and the several branches of this department.

Location.—Washington, D. C.

Date begun.—Department was created in 1862; raised to the rank of an executive department in 1889.

Assignment.—David F. Houston; F. R. Harrison, private secretary.

Proposed expenditures, 1915–16.—$30,860 (including $6,290, details from bureaus).

ASSISTANT SECRETARY'S OFFICE.

Assistant Secretary's Office:

Object.—The Assistant Secretary of Agriculture becomes Acting Secretary in the absence of the Secretary, and assists in the general supervision of the work of the department.

Cooperation.—Other departments and all branches of this department.

Location.—Washington, D. C.

Date begun.—The Office of Assistant Secretary was created in 1889.

Assignment.—Carl Vrooman.

Proposed expenditures, 1915–16.—$18,050 (including $7,000, details from bureaus).

SOLICITOR'S OFFICE.

Solicitor's Office:

Object.—The Solicitor is charged by law (act of May 26, 1910) with the direction of the legal work of the department. Accordingly, he acts as legal adviser to the Secretary and the heads of the several branches of the department, conducts its legal work, and represents it in all legal matters. He approves, in advance of issue, all orders and regulations promulgated by the Secretary under statutory authority.

Cooperation.—All branches of the department, United States attorneys, etc.

Location.—Washington, D. C.; Missoula, Mont.; Portland, Oreg.; Ogden, Utah; San Francisco, Cal.; Denver, Colo.; and Albuquerque, N. Mex.

Date begun.—1905 (General Order 85).

Assignment.—Francis G. Caffey.

Proposed expenditures, 1915–16.—$171,280 (including $8,220, details from bureaus, and $70,000, acquisition of lands).

DISBURSING OFFICE.

Disbursing Office:

Object.—To keep appropriate ledgers relative to the advance and disbursement of all items of appropriations and to pay all accounts properly certified by the various branches of the department.

Cooperation.—All branches of the department.

Location.—Washington, D. C.

Date begun.—1862.

Assignment.—A. Zappone.

Proposed expenditures, 1915–16.—$42,020 (exclusive of $5,200, details to the Secretary's Office).

LIBRARY.

Library:

Object.—To assist the workers of the department by supplying literature on agriculture and kindred subjects. The library is charged with the purchase of all books and periodicals and supervises their arrangement, cataloguing, and use; prepares for publication bibliographies of special subjects, and also has charge of the foreign mailing lists for the department publications.

Cooperation.—All branches of the department, the Congressional Library, and other libraries in and outside of Washington, D. C.

Location.—Washington, D. C.

Date begun.—1862.

Results.—The library has been enriched by approximately 9,000 accessions during the fiscal year ended June 30, 1915, not including current numbers of periodicals. Approximately 2,000 periodicals were received currently. Approximately 75,600 books and 175,000 current periodicals were circulated.

Assignment.—Claribel R. Barnett.

Proposed expenditures, 1915–16.—$46,920.

OFFICE OF INFORMATION.

Office of Information:

Object.—To secure the widest possible circulation for the discoveries and recommendations of the scientists, specialists, and field workers of the department, agricultural advice, warnings, and information as to regulatory matters; and to supply the public press with facts taken from publications and also from oral statements of specialists in a form to attract attention and lead to the adoption of the methods recommended. A specialized information service exclusively for agricultural papers has been inaugurated.

Cooperation.—All branches of the department. The office also issues a Weekly News Letter containing seasonal and other information in a popular form and has editorial supervision over the Departmental Circular. The latter publication is designed as a medium for conveying official information to the personnel of the department.

Location.—Washington, D. C.

Date begun.—1913.

Assignment.—G. W. Wharton.

Proposed expenditures, 1915–16.—$18,060 (including $10,180, details from bureaus).

OFFICE OF INSPECTION.

Office of Inspection:

Object.—To act as the clearing house of the Secretary's office in fiscal transactions between the bureaus and claimants and otherwise assist in the fiscal operations of the bureaus; to handle fiscal correspondence between the Secretary's office and the Treasury Department and personnel inspection matters; and to prepare certain annual and other reports.

Cooperation.—All branches of the department.

Location.—Washington, D. C.

Date begun.—1914.

Assignment.—Alex. McC. Ashley.

Proposed expenditures, 1915–16.—$21,410 (including $3,270, details from bureaus).

OFFICE OF EXHIBITS.

Office of Exhibits:

Object.—To handle the correspondence of the department relative to exhibits at fairs and expositions of various kinds; cooperate with the several branches of the department in preparing exposition material; ship, install, display, and care for such exhibits; and investigate methods of displaying them. During the present year the office is supervising and demonstrating the exhibit of the department at the Panama-Pacific International Exposition, San Francisco, Cal., and will make preparations

Office of Exhibits—Continued.

for and conduct an exhibit at the International Dry-Farming Congress, Denver, Colo.

Cooperation.—All branches of the department, State Department, Government Exhibit Board, State colleges and experiment stations, and fair, exposition, and show associations of various kinds throughout the United States.

Location.—Washington, D. C.

Date begun.—1913.

Results.—Since July 1, 1913, has handled agricultural exhibits at the following expositions: International Congress of Refrigeration, Chicago, Ill.; National Conservation Congress, Knoxville, Tenn.; International Dry-Land Congress, Tulsa, Okla.; United States Land Show, Chicago, Ill.; Sixth National Corn Exposition, Dallas, Tex.; Forest Products Expositions, Chicago, Ill., and New York, N. Y.; International Dry-Farming Congress, Wichita, Kans.; Panama-Pacific International Exposition, San Francisco, Cal.; and minor fairs, expositions, displays, etc. Has handled all matters relative to expositions and exhibits and acted as a center for information upon this subject.

Assignment.—F. Lamson-Scribner.

Proposed expenditures, 1915–16.—$24,830.

OFFICE OF FOREST APPEALS.

Office of Forest Appeals:

Object.—Created for the purpose of having, under the immediate supervision of the Secretary, an officer independent of the Forest Service, by whom appeals from the decision of that bureau affecting land claims and land classification matters might be passed upon, after a careful examination of the record and a consideration of the questions involved, in order that the Secretary might thus be assisted in reaching a final decision. At the direction of the Secretary the office also cooperates with the Office of Inspection in the investigation of personnel cases involving discipline, demotion, or dismissal, and complaints by or against bureau or department officers.

Cooperation.—Forest Service, in appeal cases; Office of Inspection, in connection with personnel cases.

Location.—Washington, D. C.

Date begun.—1913.

Results.—During the past year 51 appeal cases and 8 petitions or requests for review have been considered and recommendations made thereon for action by the Secretary.

Assignment.—Thos. G. Shearman.

Proposed expenditures, 1915–16.—$5,250 (including $5,200, detail from Forest Service).

CHIEF CLERK'S OFFICE.

Chief Clerk's Office Proper:

Object.—The chief clerk has general supervision of clerks and employees, of the order of business, of the records and correspondence of the Secretary's office, and of expenditures from appropriations for miscellaneous expenses, rent of buildings, etc. He is responsible for the enforcement of the general regulations of the department and is custodian of the buildings. This project includes work of the time clerk, operation of the telephone and telegraph booth, and provision for miscellaneous supplies and services for the department as a whole.

Cooperation.—Various branches of the department.

Location.—Washington, D. C.

Date begun.—1862.

Assignment.—R. M. Reese.

Proposed expenditures, 1915–16.—$36,876 (including $2,300, details from bureaus).

Appointment Clerk's Office:

Object.—To prepare all papers relating to appointments, transfers, promotions, reductions, details, furloughs, and removals; to keep personal records of employees, etc.

Appointment Clerk's Office—Continued.

Cooperation.—All branches of the department.

Location.—Washington, D. C.

Date begun.—1891.

Assignment.—R. W. Roberts.

Proposed expenditures, 1915–16.—$15,870 (including $2,100, details from bureaus).

Supply Section:

Object.—To make purchases of stationery and miscellaneous supplies for the Office of the Secretary and the various bureaus; and to receiv and dispose of, by sale or otherwise, all property turned in by the various bureaus and offices when of no further use; also to sell unused samples of products secured in connection with the enforcement of the food and drugs act and the insecticide act.

Cooperation.—All branches of the department.

Location.—Washington, D. C.

Date begun.—About 1883.

Assignment.—C. B. Lower.

Proposed expenditures, 1915–16.—$16,015 (including $900, detail from Bureau of Plant Industry).

Chief Engineer's Office:

Object.—To supervise the engineers, firemen, and elevator-operator force, except those of the Weather Bureau, and to provide heat, light, power, and electricity for all buildings of the department in Washington, except those occupied by the Weather Bureau, Forest Service, and Office of Public Roads and Rural Engineering.

Cooperation.—Various branches of the department.

Location.—Washington, D. C.

Date begun.—About 1877.

Assignment.—R. Augusterfer.

Proposed expenditures, 1915–16.—$86,794 (including $3,140, details from bureaus).

Mail and Files:

Object.—To receive, record, and distribute mail for the Office of the Secretary; index, copy, file, and dispatch correspondence. The department post office receives, distributes, and dispatches mail handled between the city post office and the several bureaus.

Cooperation.—Other branches of the department.

Location.—Washington, D. C.

Date begun.—1862.

Results.—Approximately 400,000 letters, papers, etc., handled during the year.

Assignment.—Joseph Haley.

Proposed expenditures, 1915–16.—$14,550 (including $1,840, details from bureaus).

Watch Force:

Object.—To protect and watch 19 buildings occupied by the department, in three shifts, covering the entire 24 hours.

Location.—Washington, D. C.

Date begun.—1862.

Results.—Three fires detected and extinguished by watchmen.

Assignment.—A. A. Ormsby.

Proposed expenditures, 1915–16.—$38,625 (exclusive of $1,920, details to Division of Publications).

Shop Force:

Object.—To maintain mechanical shops for the repair and upkeep of the buildings, laboratories, and equipment, including carpenter work and painting.

Cooperation.—Various branches of the department.

Location.—Washington, D. C.

Date begun.—1909.

Assignment.—R. M. Reese.

Proposed expenditures, 1915–16.—$65,750 (including $2,540, details from bureaus).

Char Force:

Object.—To clean and keep in sanitary condition the halls and toilets of the department buildings, and to clean the rooms in the different units of the Office of the Secretary.

Cooperation.—Various branches of the department.

Location.—Washington, D. C.

Date begun.—Many years ago.

Assignment.—R. M. Reese.

Proposed expenditures, 1915–16.—$20,180 (including $1,680, details from bureaus).

Rubber-Stamp Work:

Object.—To manufacture rubber stamps for official use.

Cooperation.—All branches of the department except the Weather Bureau.

Location.—Washington, D. C.

Date begun.—1895.

Assignment.—R. M. Reese.

Proposed expenditures, 1915–16.—$3,840 (including $1,440, detail from Office of Public Roads and Rural Engineering).

Stables:

Object.—To feed, care for, and drive the horses and care for the vehicles used by the Office of the Secretary and the Division of Publications.

Location.—Washington, D. C.

Date begun.—Many years ago.

Assignment.—R. M. Reese.

Proposed expenditures, 1915–16.—$11,960 (including $840, detail from Bureau of Animal Industry).

Rent in the District of Columbia:

Object.—To administer the appropriation for rent in the District of Columbia for the various branches of the department, 22 buildings and parts of buildings being under rental.

Location.—Washington, D. C.

Date begun.—Many years ago.

Assignment.—R. M. Reese.

Proposed expenditures, 1915–16.—$133,689 (including $10,000 from appropriation for meat inspection, Bureau of Animal Industry).

Total, Chief Clerk's Office, $444,149 (including $26,780, details from bureaus, and excluding $7,360, details to bureaus).

OFFICE OF FARM MANAGEMENT.

ADMINISTRATION.

General Administration:

Object.—To supervise the investigations relating to farm management and farm practice and studies of the clearing and utilization of logged-off lands, and to direct the administrative and clerical routine.
Location.—Washington, D. C.
Date begun.—1905.
Assignment.—W. J. Spillman, E. H. Thomson.
Proposed expenditures, 1915–16.—$10,160.

Finances:

Object.—To provide a practical system of keeping the financial records; render all possible assistance to employees in the adjustment of their accounts and prepare a monthly statement showing allotments, expenses, and balances of the funds allotted to each section; prepare letters of authorization and requests for appointments; handle all requisitions for supplies and miscellaneous requests for express, freight, and shop work; provide for all mimeograph and flexotype work, chart making, etc.; assist authors in the preparation of manuscripts for publication, including selection of illustrations, reading and correcting proof; also handling of all job printing matter, etc.
Location.—Washington, D. C.
Date begun.—1905.
Assignment.—W. J. Spillman, Lisle Morrison.
Proposed expenditures, 1915–16.—$14,867.

Records:

Object.—To keep on file, or request from other libraries, literature that is needed by the office staff, and keep copies of all manuscripts, field reports, etc.; furnish to the scientific staff lantern slides for lectures, bromide enlargements, reproductions of maps, illustrations for reports, bulletins, and the various publications of the office, and to develop and make prints of negatives sent in from the field; keep a record and file of all correspondence received in and emanating from the office.
Location.—Washington, D. C.
Date begun.—1905.
Assignment.—W. J. Spillman, Lisle Morrison.
Proposed expenditures, 1915–16.—$9,585.

Total, Administration, $34,612.

[Research.]

INVESTIGATIONS IN FARM MANAGEMENT AND FARM PRACTICE.

FARM ECONOMICS.

Crop Economics:

Object.—This project deals with farm practice in the production of the various farm crops, the equipment required, the cost of production, the profitableness of the enterprises based on these crops, and the geographic and economic conditions which render these crops desirable as a basis of a portion of the farm business.
Procedure.—The work is conducted by cost-accounting studies on a number of farms in districts where the various crops are of primary importance. These results from field investigations are compiled and summarized to determine the best farm practice, as well as the economic factors involved.
Cooperation.—Bureau of Plant Industry; Wisconsin, Minnesota, and New York State colleges of agriculture; and various farmers in different parts of the country.

Crop Economics—Continued.

Location.—Important crop-producing districts in various States according to the kind of crop studied.

Date begun.—1906.

Results.—The crops which are at present under investigation are sugar beets, apples, hay, potatoes, corn for silage, and field beans. Several hundred field records have been taken, and these are being compiled and prepared for publication. Department Bulletin 130, "Operating Costs of a Well-Established New York Apple Orchard," has been published.

Assignment.—E. H. Thomson, L. A. Moorhouse, C. M. Bennett.

Proposed expenditures, 1915–16.—$34,900.

Live-Stock Economics:

Object.—To investigate the cost of producing various types of live stock and live-stock products under different conditions and for different sections of the country and to determine the equipment required by each for its successful conduct and the profits realized therefrom. Attention is given to the geographic, economic, and other conditions under which each type of live stock is a desirable farm enterprise.

Procedure.—These studies are conducted by making careful analyses, especially of the economic features, of the various live-stock enterprises on a large number of farms in live-stock producing centers.

Cooperation.—Bureau of Animal Industry.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Several hundred records have been obtained from farmers in the Central West on the cost of producing beef animals, the cost of maintaining breeding herds, and of raising and finishing calves for baby beef. These results have been summarized and a report submitted to the committee appointed by the Secretary of Agriculture to study the economics of the meat situation. Publication issued: Farmers' Bulletin 588, "Economic Cattle Feeding in the Corn Belt."

Assignment.—E. H. Thomson, J. S. Cotton.

Proposed expenditures, 1915–16.—$9,920.

Farm Surveys:

Object.—To determine the farmer's investment, receipts, expenditures, and net income from the farm business and the important factors which largely control this income. Includes studies of the relation of profit to size of business, diversification, and efficiency of the various farm enterprises, cost of the farmer's living, and amount of products contributed directly by the farm; studies of systems of farm tenure and the underlying principles of tenant farming.

Procedure.—A complete financial analysis of a large number of farms in specific areas is made. Average results are thus obtained and an accurate determination made of farm conditions. These individual farm analyses are summarized and classified in various ways to determine what each farmer receives for his year's work and to learn the effect on profits received of such factors as size of business, yield of crops, use of labor and machinery, and general efficiency of operation.

Cooperation.—States Relations Service; Wisconsin Experiment Station; and various other State institutions.

Location.—Chester County, Pa.; Lenawee County, Mich.; Clinton County, Ind.; Utah County, Utah; Dane County, Wis.; Sumter County, Ga.; and various other areas in the several States.

Date begun.—1906.

Results.—Analyses have been made of several thousand farms in the areas mentioned; important results obtained in respect to the underlying causes of success or failure in farming; the effect of magnitude of business and quality of the various enterprises determined. Valuable data have been obtained on the cost of the farmer's living and what the farm contributes directly in the form of garden products, milk, butter, eggs, etc. Facts have been determined concerning systems of tenure and methods by which present farm owners acquired their status as farmers; this study dealing with the reasons for migration of young people from the farm to the city.

Assignment.—E. H. Thomson, H. M. Dixon.

Proposed expenditures, 1915–16.—$21,525.

Farm Equipment:

Object.—Determination of the character, cost, and adequacy of equipment in machinery, implements, work horses, etc., on farms of different types and sizes in different sections of the country.

Procedure.—Large masses of data dealing with the farmer's experience in regard to the items of farm equipment are collected. These field results are compiled and reports prepared dealing with the cost, character, and adequacy of the various types.

Cooperation.—Bureau of Plant Industry.

Location.—General.

Date begun.—1906.

Results.—Special attention is being given to the use of tractors on the farm, the preliminary results of which are published in Department Bulletin 174, "Farm Experience with the Tractor"; showing the character and cost of the various types of farm fences found in different sections of the country; and the practicability and efficiency of the different systems in greenhouse heating. Manuscripts on these subjects are ready for publication.

Assignment.—E. H. Thomson, A. P. Yerkes, H. N. Humphrey, L. L. Corbett.

Proposed expenditures, 1915-16.—$9,960.

History and Distribution of Farm Enterprises:

Object.—To determine the geographic factors which control the distribution of the various crops and types of live stock in this country. Involves a study of the history of farming with a view to gaining further insight into the forces that determine the distribution of agricultural enterprises.

Procedure.—Compilation of large masses of geographic and statistical data, conducted largely in cooperation with the various bureaus of this department and with the Bureau of Census in the Department of Commerce.

Cooperation.—Various bureaus of the department, Bureau of Census, and the Wisconsin Experiment Station.

Location.—Washington, D. C., and Madison, Wis.

Date begun.—1912.

Results.—A large amount of data collected by various Government agencies has been correlated. These data are being prepared for maps, charts, etc., showing the distribution of various crops and types of live stock in this country and for an atlas of American agriculture.

Assignment.—E. H. Thomson, O. E. Baker.

Proposed expenditures, 1915-16.—$29,140.

Farm Accounts:

Object.—To investigate and determine practical methods of farm bookkeeping and accounting.

Procedure.—Studies are made of various existing systems of bookkeeping as worked out by farmers in different parts of the country and by other individuals interested in that line of research. Records are also kept on a large number of farms to test the practicability of different methods.

Location.—Washington, D. C., and various farms in different parts of the country.

Date begun.—1906.

Results.—Valuable data have been collected regarding the practicability of several systems. These data have been compiled and published in Farmers' Bulletins 511, 572, and 661.

Assignment.—E. H. Thomson, C. M. Bennett, J. S. Ball.

Proposed expenditures, 1915-16.—$4,700.

Total, Farm Economics, $110,145.

FARM ORGANIZATION.

Farm Organization in the Northeastern States:

Object.—To secure information as to systems of organization and operation for farms of the different sizes and types, so as to permit the best possible utilization of labor and capital within the limits of the operator's environment and resources.

Procedure.—Careful analytical studies are made of farm organization of individual farms in regional groups. By a system of measuring the

Farm Organization in the Northeastern States—Continued.

relative efficiency of different types of organizations found, logical recommendations for the improvement of farm organization for the region are possible.

Cooperation.—In counties having a county agent the survey work is, as a rule, done cooperatively with this agent, each party being entitled to the use of all field records made. The results of the studies of these records are published as bulletins from this office.

Location.—Washington, D. C., and Northeastern States.

Date begun.—1913.

Results.—During the summer and fall of 1914 a study was made of nine groups of farms covering, in a broad way, the southern half of the New England States. Forty to sixty farms were included in each group studied. In this region, through cooperation and exchange records with demonstration agents, 400 additional records are made available. The results of the studies of these records will be offered for publication within a few months. In 1912 a farm-management survey was conducted in five or six townships in southern Chester County, Pa. This survey included between 500 and 600 farms, the results of which have been tabulated and are ready for publication. In 1914 a crop-enterprise survey was conducted in the same region and also in adjacent portions of Chester County, Pa., having similar agricultural conditions. In 1914 an enterprise survey was made in Chester County, Pa., in the region covered by a general survey in 1912, the object of which was to study other factors in farm practice and labor requirements for all enterprises, so as to fully analyze the farms in that region. From these data profitable systems of farm organization for different types of farming are shortly to be published.

Assignment.—J. S. Cates.

Proposed expenditures, 1915–16.—$21,140.

Farm Organization in the North-Central States:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—Same as preceding project.

Location.—Washington, D. C., and North-Central States.

Date begun.—1913.

Results.—A study is being made of systems of farming adapted to the cutover lands of Michigan, Wisconsin, and Minnesota. A report embodying the results of this study will be prepared during the coming year. The study will be based on records of more than 1,000 farms, which records are being taken by the survey method. A study is also being made concerning the best types of farming for the swamp lands of the North-Central States. Six or eight months will yet elapse before material from this study will be offered for publication. One publication has been issued outlining a labor-saving type of farming adapted to the corn-belt States. In the manuscript prepared has been embodied investigations concerning types of farming best adapted to the sandy lands in northern Indiana and southern Michigan. A general study is being made throughout this whole region concerning the best methods of fitting alfalfa in with the other general crops now grown, in such a way as to make an efficient utilization of labor. Another study has been made concerning the seasonal distribution of labor on crop enterprises in the valley of the Red River of the North. The data obtained have been summarized and are in process of preparation.

Assignment.—J. C. McDowell.

Proposed expenditures, 1915–16.—$27,760.

Farm Organization in the Southern States:

Object.—Same as preceding project.

Procedure.—Farms are studied in community groups. These groups are so distributed as to cover a broad region of more or less agricultural unity. In all cases a study is conducted by the farm-management survey method.

Farm Organization in the Southern States—Continued.

Cooperation.—West Virginia, North Carolina, South Carolina, and Texas experiment stations, Georgia College of Agriculture, and Chambers of Commerce of Baton Rouge and Shreveport, La.

Location.—Washington, D. C., and Southern States.

Date begun.—1913.

Results.—During the past year a farm-enterprise survey was made in Hidalgo and Cameron Counties, Tex. This is being followed up by further survey studies, and a report embodying the results of these studies will be prepared within the coming year. A survey has just been completed in Ellis County, Tex., the results of which, it is expected, will be offered for publication in about six months. Surveys are in progress in north-central Oklahoma and central Kansas, with Kay County, Okla., as a center. The results of these studies will be offered within the coming year. A survey has been completed in the hill and river counties of northwestern Louisiana. This survey embodies over 1,400 records, the result of the study of which will be offered for publication within the coming year. A study of a large group of farms in Arkansas has been made with reference to their organization; also covering a comparison of the survey method of taking estimates and actual records kept by the farmers.

A survey is now being conducted in Coahoma County, Miss., the results of which will be offered for publication some time during the year.

In Georgia a survey covering Houston, Sumter, Bibb, and Spalding Counties has been completed, and the results are now being compiled for publication. A survey has been made in Catawba County, N. C., embodying a large number of records, which will be tabulated and offered for publication in the near future. A survey embodying over 500 farm records has been made in the four northern counties of Virginia. This material will be ready for publication at the close of the calendar year. During the past year a survey has been made in Mason, Scott, and Madison Counties, Ky. A manuscript based on this survey is now ready for publication. A survey embodying nearly 1,000 records has been made during the past year in Brooke and Preston Counties, W. Va. This material is being compiled, and the manuscript thereon will soon be offered for publication.

Assignment.—C. L. Goodrich.

Proposed expenditures, 1915–16.—$47,863.

Farm Organization in the Western States:

Object.—To study organizations as found on farms at the present time with a view to ascertaining the most profitable and economic grouping of the different enterprises making up the farm unit.

Procedure.—Same as preceding project.

Cooperation.—Wherever feasible, field records are taken in cooperation with the extension departments of the different States.

Location.—Washington, D. C., and Western States.

Date begun.—1913.

Results.—A study is being made of farm organization in the Palouse country in eastern Washington. This study will continue for one year longer, when a report embodying the results will be prepared. A similar study is being made in Marion County, Oreg. It is estimated that this work will take a year or more for completion. A reconnoissance survey has been made in the citrus belt of southern California preparatory to a more complete study of the problems of organization confronting orange growers of this region. This study will continue for another year before results will be ready for publication. In the irrigated sections of Arizona and New Mexico a farm-management survey embodying 584 records has just been completed. This material is now being prepared for publication.

Assignment.—D. A. Brodie.

Proposed expenditures, 1915–16.—$24,560.

Total, Farm Organization, $121,323.

Total, Investigations in Farm Management and Farm Practice, $231,468.

[Research.]

CLEARING AND UTILIZATION OF LOGGED-OFF LANDS.

Clearing and Utilization of Logged-Off Lands:

Object.—To determine the methods used in the various timbered sections of the United States in clearing stumps from land from which the timber has been taken and putting such land in shape for agricultural purposes, to ascertain the cost of these various methods, and to determine the most practicable methods to be used under various conditions.

Procedure.—Studies of methods and costs of burning and removing stumps from cut-over lands are made, including methods employed by settlers and by companies developing large tracts of land with expensive equipment specially designed for the purpose of clearing-off such types of land.

Location.—Cut-over sections of the United States.

Date begun.—In 1908.

Results.—Data published in Department Bulletin 91, Farmers' Bulletin 600, etc. More recent results are now being summarized preparatory to further publication.

Assignment.—Harry Thompson, Earl D. Strait.

Proposed expenditures, 1915–16.—$5,000.

WEATHER BUREAU.

CENTRAL OFFICE.

GENERAL ADMINISTRATION.

Office of Chief:

Object.—To direct the policy and business affairs of the bureau and to supervise its public service and scientific activities.

Location.—Washington, D. C.

Date begun.—1891 (date of transfer of meteorological work to the Department of Agriculture; meteorological work began November 1, 1870, under War Department, Signal Corps, U. S. A.).

Assignment.—C. F. Marvin.

Proposed expenditures 1915–16.—$8,400.

Office of Assistant Chief:

Object.—To supervise matters pertaining to the personnel of stations and such other matters as are not specifically assigned to the various divisions. In the absence of the chief, the assistant chief assumes the duties of that official.

Procedure.—This office recommends appointments and promotions, details and assigns officials and employees to duty at the various stations, and by correspondence and telegraph supervises such other matters as are not specifically assigned to the various divisions.

Location.—Washington, D. C.

Date begun.—1891.

Assignment.—C. C. Clark.

Proposed expenditures 1915–16.—$3,750.

Office of Chief Clerk:

Object.—To supervise the personnel of the central office, carry on administrative, clerical, and other work in connection with files, mail, drawings, photographs, and lantern slides; and to care for buildings and grounds, stable, horses, and vehicles.

Location.—Washington, D. C.

Date begun.—1891.

Assignment.—E. B. Calvert.

Proposed expenditures 1915–16.—$62,730.

Instruments:

Object.—To supervise the issue, exposure, and installation of the entire instrumental equipment of the bureau; and to supervise the equipment and personnel of the storm-warning stations of the bureau.

Location.—Washington, D. C.

Date begun.—1891.

Assignment.—B. C. Kadel.

Proposed expenditures 1915–16.—$15,020.

Telegraph and Telephone:

Object.—To maintain a branch telegraph and telephone office for the administrative and overhead functions of the Washington office.

Location.—Washington, D. C.

Date begun.—1891.

Assignment.—E. B. Calvert.

Proposed expenditures 1915–16.—$2,000.

Stations and Accounts:

Object.—To supervise the issuing of authorizations for all expenditures; audit, adjust, and prepare for payment all accounts and claims against the Weather Bureau and keep all books and other records in connection therewith; prepare annual estimates of appropriations; select and rent

Stations and Accounts—Continued.

quarters and offices; supervise the construction and repair of all Weather Bureau buildings outside of Washington.

Cooperation.—Solicitor of department.

Location.—Washington, D. C.

Date begun.—1891.

Results.—A number of offices located in better quarters; new buildings completed at Cincinnati, Ohio, and Sandy Hook, N. J.

Assignment.—D. T. Maring.

Proposed expenditures, 1915–16.—$22,800.

Supplies:

Object.—To supervise, purchase, and distribute all Weather Bureau supplies; care and account for all bureau property; provide for the condemnation, sale, and disposition by other means of property and supplies lost, stolen, or worn out in service.

Location.—Washington, D. C.

Date begun.—1891.

Assignment.—B. A. Blundon.

Proposed expenditures, 1915–16.—$15,760.

Forecasts:

Object.—To supervise all forecast work done at outlying stations of the bureau, including publication and dissemination by maps, cards, telegraph and telephone messages, and press reports of weather synopses and general forecasts.

Location.—Washington, D. C.

Date begun.—1891.

Assignment.—H. E. Williams.

Proposed expenditures, 1915–16.—$8,500.

River and Flood Work:

Object.—To supervise the river and flood work conducted at the outlying stations, including their coordinated and related substations; maintain river-gauging stations and disseminate river information.

Cooperation.—Forest Service and Geological Survey.

Location.—Washington, D. C.

Date begun.—1891.

Assignment.—A. J. Henry.

Proposed expenditures, 1915–16.—$5,000.

Climatological Work:

Object.—To supervise cooperative and special stations maintained in connection with the corn, wheat, cotton, sugar, and rice industries; check and verify station reports and file original records at the central office; supervise the publication at section centers of the monthly reports of climatological data.

Cooperation.—Canadian Government.

Location.—Washington, D. C.

Date begun.—1891.

Assignment.—P. C. Day.

Proposed expenditures, 1915–16.—$29,800.

Editorial Work:

Object.—To supervise all editorial work in connection with manuscripts of technical meteorological papers submitted for publication, including the Monthly Weather Review, its supplement, annual summary, and any other publications of a general meteorological character that may be authorized.

Location.—Washington, D. C.

Date begun.—1891.

Assignment.—C. Abbe.

Proposed expenditures, 1915–16.—$6,400.

Library:

Object.—To maintain a library in Washington, supervise station libraries, prepare indexes and bibliographic lists of meteorological and allied literature, translate correspondence in foreign languages, and conduct promotion examinations.

Library—Continued.

Cooperation.—Governments of Canada, England, France, Germany, and various meteorological and scientific societies of the United States and foreign countries.

Location.—Washington, D. C.

Date begun.—1891.

Results.—Practically all of the knowledge on the science of meteorology and allied sciences from its inception down to the present time is made readily accessible through this library to the scientific and other employees of the Government and the public generally. Twelve hundred books and pamphlets added to library; 500 books added to station libraries. See Monthly Weather Review for current bibliography of meteorology. Fifty-nine employees have been examined by the professor in charge.

Assignment.—C. F. Talman.

Proposed expenditures, 1915–16.—$7,680.

Printing:

Object.—To publish the Monthly Weather Review and other general publications, and print cards, franks, forms, and central office and station instructions.

Location.—Washington, D. C.

Date begun.—1891.

Assignment.—R. Seyboth.

Proposed expenditures, 1915–16.—$11,750.

Total, General Administration, $199,590 (service, $193,090; research, $6,500).

THE WASHINGTON STATION.

[Service.]

Collection and Dissemination of Climatological and Meteorological Information:

Object.—To observe and record weather conditions in Washington; chart and study telegraphic reports of weather conditions in the Northern Hemisphere; issue forecasts and frost, cold-wave, flood, storm, small-craft, and hurricane warnings; disseminate meteorological and climatological information by telegraph, telephone, maps, cards, and bulletins.

Procedure.—Meteorological conditions are determined at 8 a. m. and 8 p. m. by actual observation of the atmosphere and readings of meteorological instruments. These observations, together with simultaneous observations taken at the outlying stations of the bureau, assembled by telegraph, are charted on maps for study and interpretation by trained experts, who issue forecasts and the necessary wind, frost, hurricane, or other warnings and other meteorological information, which is disseminated by means of maps, bulletins, cards, telegraph, telephone, and otherwise. Climatological and special crop data are compiled and distributed by bulletins.

Cooperation.—Government of Canada; Smithsonian Institution; University of Pittsburgh; Alaska Agricultural Experiment Station; Bureau of Fisheries; Geological Survey.

Location.—Washington, D. C.

Date begun.—1891.

Results.—A. M. forecasts issued daily for New England, North and South Atlantic, East Gulf, Ohio Valley, and the lower Lake regions; frost warnings for special crops; warnings of "high" winds and hurricanes issued when necessary for the same region; P. M. forecasts issued for entire United States except Pacific coast; daily maps, weekly bulletins, and the Monthly Weather Review published.

Assignment.—H. E. Williams, E. H. Bowie, H. C. Frankenfield, A. J. Henry, P. C. Day, T. T. Moore, R. Seyboth.

Proposed expenditures, 1915–16.—$122,880.

[Research.]

Improvement in Instrumental Equipment:

Object.—To select, test, improve, and design instrumental apparatus for the scientific work of the bureau.

Procedure.—Experts select and test all instrumental equipment by usual laboratory methods, and design and construct new types demanded by Weather Bureau work.

Location.—Washington, D. C.

Date begun.—1891.

Results.—The following instrumental equipment designed: Marvin evaporation hook gauge; the Kadel evaporation still-well; the Kadel 100-inch snow-density tube; and the Marvin 8-day self-contained automatic rain gauge.

Assignment.—B. C. Kadel.

Proposed expenditures, 1915–16.—$1,500.

Investigations of the Problems of Forecasting:

Object.—To improve the accuracy of forecasts and to formulate rules and enunciate principles in connection therewith.

Procedure.—A study of the weather maps and other meteorological data with reference to storms of different types and of their effects upon weather conditions throughout the United States.

Location.—Washington, D. C.

Date begun.—1891.

Results.—Monthly Weather Review, Supplement No. 1. Important information regarding storm movements and weather forecasting is now being prepared for publication under the title, "Forecasting in the United States."

Assignment.—A. J. Henry, H. C. Frankenfield, E. H. Bowie, R. H. Weightman.

Proposed expenditures 1915–16.—$4,100.

Investigations in Climatology:

Object.—To determine more fully the climate of the entire United States, including the insular possessions.

Procedure.—Compilation and reduction of the daily meteorological records from the large corps of observers scattered throughout all portions of the country; publication of data in the form of tables, charts, and diagrams; and discussion of the conditions disclosed from an examination and study of the data collected.

Cooperation.—Several bureaus of the department; other departments, State agricultural and meteorological organizations, colleges, railroads, and public and private institutions and corporations interested in collecting and disseminating such information.

Location.—Washington, D. C.

Date begun.—1891.

Results.—Many data prepared and distributed and work on additional statistics under way.

Assignment.—P. C. Day.

Proposed expenditures 1915–16.—$3,500.

River and Flood Investigations:

Object.—To improve methods of flood forecasting.

Procedure.—Compiling records of precipitation in the various watersheds and attempting to correlate them with resulting flood stages; seeking to determine the relation between rainfalls of varying intensities and the stages of water reached in the rivers.

Location.—Washington, D. C.

Date begun.—1891.

Results.—Schemes for river forecasting for certain rivers of South Carolina have been completed and compilations of flood and precipitation data made for portions of the Ohio Basin.

Assignment.—A. J. Henry.

Proposed expenditures 1915–16.—$1,550.

Solar Radiation Investigations:

Object.—(1) To determine the insolation received in heat units on a horizontal surface from the sun and sky under all sky conditions; (2) determine the radiation received on a normal surface in gram calories; (3) establish normals for insolation; (4) determine the relation between polarization and insolation on clear days; (5) determine the effect of atmospheric conditions on nocturnal radiation; (6) measure the insolation received through ray filters under different conditions.

Procedure.—Pyrheliometric, polarimetric, nocturnal radiation, and other observations are maintained continuously; data computed, plotted, and reduced; instruments standardized.

Cooperation.—Bureau of Standards furnishes ray filters, delicate thermopiles, nocturnal radiation instruments, and other instruments.

Location.—Washington, D. C.

Date begun.—1913.

Results.—Factors obtained for the reduction of the Callendar records to heat units. Instruments at several stations have been checked and restandardized. Curves of average and maximum radiation for an eight-year period have been established. The Callendar pyrheliometer has been standardized. The division of the total radiation received into two components has been obtained by means of solar screens, as follows: (1) Solar radiation, (2) sky radiation.

Assignment.—H. H. Kimball.

Proposed expenditures 1915–16.—$3,800.

Meteorological Investigations:

Object.—To determine the nature of meteorological phenomena and the laws of their actions.

Procedure.—Comparison and study of observational data in relation to cause and effect. Meteorological phenomena of whatever kind are regarded as physical phenomena, with physical causes and obeying physical laws.

Location.—Washington, D. C.

Date begun.—1913.

Results.—"American Temperatures and European Railfall," Journal, Washington Academy of Science, 4, p. 345, 1914. It was found that the annual rainfall of northern and western Europe increases and decreases with the annual average temperature of the eastern United States. The reason why this should be so was pointed out. "The Thunderstorm and Its Phenomena," Monthly Weather Review, 42, p. 348, 1914. This is a very long article that discusses all phases of the thunderstorm, with many new features. It especially explains for the first time the mechanics of the storm and its several peculiar types of air movement. "Frost Protection," Monthly Weather Review, 42, p. 562, 1914. Frost protection is regarded and treated as a problem in physics and the fundamental principles explained. It is shown that frost protection usually is feasible, and the methods that should be followed for the accomplishment of the best practical results—saving the fruit at least cost—are indicated. "Why Some Winters Are Warm and Others Cold in the Eastern United States," Monthly Weather Review, 42, p. 562, 1914. It is shown, by the aid of many charts, that the winter temperature of the eastern United States is determined by the direction of the coastal winds and these in turn largely by the presence or absence of the Bermuda "high." When the barometric pressure is persistently high in the neighborhood of the Bermudas during winter, the eastern United States has on-shore winds and relatively high temperatures. On the other hand, when the barometric pressure in the Bermuda region is low, the winds are offshore and the eastern United States comparatively cold.

Assignment.—W. J. Humphreys.

Proposed expenditures, 1915–16.—$1,800.

Aerological Research:

Object.—To increase our knowledge of dynamic meteorology.

Procedure.—Computing, plotting, comparing, and reducing observations obtained in the lower (surface to 3 or 4 kilometers) strata of the atmosphere by means of kites and captive balloons; in the higher (surface to 20 or 30 kilometers) strata by means of free balloons.

Aerological Research—Continued.

Location.—Washington, D. C.

Date begun.—1914.

Results.—A series of free-balloon observations was made in July, 1914. The reduction of these observations is not yet complete. Kite meteorographs tested and standardized.

Assignment.—W. R. Blair, W. R. Gregg.

Proposed expenditures, 1915–16.—$4,700.

Seismological Investigations:

Object.—To map the United States according to seismological activity and locate geological faults; to study in detail earthquake vibrations and draw inferences therefrom in regard, on the one hand, to the scientifically important problem of the structure of the earth and, on the other, to the practical question of types of buildings best adapted to withstand seismic shocks.

Procedure.—Noninstrumental earthquakes reports on cards adapted to this purpose made at all (about 200) regular Weather Bureau stations and by some 4,000 cooperative observers are assembled and published by States. Instrumental earthquake records obtained at two Weather Bureau stations, Washington, D. C., and Northfield, Vt., and at some 20 cooperative stations in different parts of North America are also collected and published.

Cooperation.—Geological Survey.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Systematic collection of earthquake data published in the Monthly Weather Review.

Assignment.—W. J. Humphreys.

Proposed expenditures, 1915–16.—$2,800.

An Empirical Determination of the Relative Values of Evaporation in the United States:

Object.—Primary: To determine under standard conditions of exposure the relative values of evaporation in various portions of the United States. Secondary: To establish the relation between the evaporation under the above standard conditions and the climatological factors that combine to bring it about.

Procedure.—Compiling and studying data to be obtained from about thirty evaporation stations; compiling and publishing existing evaporation records.

Cooperation.—Reclamation Service, Geological Survey, Forest Service, Bureau of Plant Industry, Office of Public Roads and Rural Engineering, State organizations, and private parties. Inquiries already received from the Universities of Arizona and Nevada and the Montana Agricultural College; Public Utilities Commission, State of Maine; Valier-Montana Land & Water Co., Valier, Mont.; and Diamond Cattle Co., Rock River, Wyo.

Location.—Washington, D. C.

Date begun.—Spring of 1915.

Results.—The results of previous evaporation campaigns under the supervision of the Weather Bureau have thus far been published only in part. The work of recompiling these records for complete publication is now under way. The extensive campaign carried on at the Salton Sea and elsewhere in the United States during 1909 and 1910 under the supervision of Professor Bigelow has served to outline how many of the complexities of this problem can best be overcome.

Assignment.—B. C. Kadel, Cleveland Abbe, jr.

Proposed expenditures, 1915–16.—$1,320.

Total, Washington Station, $147,950 (service, $122,880; research, $25,070).

Total, Central Office, $347,540 (service, $315,970; research, $31,570).

WEATHER BUREAU STATIONS OUTSIDE OF WASHINGTON.

GENERAL STATEMENT OF THE WORK.

The Weather Bureau maintains about 200 regular stations outside of Washington, occupying offices in Federal buildings, rented quarters, or special buildings erected for the purpose by the department. These stations are manned by trained commissioned officials and assistants, who devote their whole time to the Weather Bureau work. Coordinated and related to these principal stations there are also maintained over 4,000 cooperative, special meteorological, and other minor stations, each of which is provided with a very simple set of instruments, installed as a rule at the residence of the observer, who gives but a few minutes of his time each day to the work. With very few exceptions no quarters are provided or rents paid, and the services are rendered gratuitously, except in some cases where the observers receive from $5 to not to exceed $25 per month. The activities at the 200, more or less, principal stations are similar in all respects to the activities described under the Washington station. All the lines of work are not performed at all the stations, nor are the same lines of work conducted at each and every station. The work, which is comprised in general under the following heads, is briefly described below.

[Service.]

Meteorological observations.—The taking, recording, enciphering, telegraphing, compiling, and tabulating of regular meteorological observations and the care and maintenance of the instrumental equipment therefor.

Daily weather forecasts.—The preparing of daily weather forecasts, including frost and cold-wave warnings and wind forecasts in connection with forest-fire prevention; also the printing of same or issuance by other means and dissemination by maps, bulletins, and telegraph and telephone messages; and press reports of weather synopses, forecasts, and full and complete information concerning the current local weather conditions in all their phases.

Storm, small-craft, and hurricane warnings.—Storm, small-craft, and hurricane warnings, disseminated at coast, Gulf, West Indies, and Great Lake stations; chiefly the distribution of such warnings and the giving out of related information through the medium of coordinated display substations and by means of printed cards, telephone messages, and otherwise.

Climatological and crop reports.—The climatological and crop reporting service comprises the collection during the crop season, from April 16 to October 31, of daily telegraphic reports from selected substations organized into services, reporting in the interests of cotton, corn, wheat, sugar, rice, tobacco, fruit, and other standard crops; includes the printing and the prompt dissemination of the information to the public, to commercial exchanges, and to all parties and organizations interested in or benefited by the service that can be promptly reached by the usual means of communication available.

River and flood warning service.—The river and flood warning service comprises the maintenance of substations which observe and report rainfall, river stages, and like conditions, and the dissemination of flood information to the public, and especially to the parties and interests most directly benefited thereby.

[Research.]

Investigations and research.—(*a*) General meteorology and climatology: Many station officials are engaged upon continuing studies carried on intermittently in general meteorology and climatology, weather forecasting, river and flood work, evaporation work, and frost-warning work as affecting and contributing to the protection of various standard crops and other allied scientific studies and investigations. (*b*) Aerology: Investigations in aerology are conducted only at Drexel and Fort Omaha, Nebr., except occasional balloon ascensions for specific purposes; comprises the study of the upper-air conditions by means of kites and balloons for the purpose of fixing the general meteorological data in the whole atmospheric mass. The results thus far obtained disclose conditions of temperature, pressure, water vapor, and wind in this region that are of great value and importance in the study of dynamic meteorology. The cost of this work is stated under the Drexel station. (*c*) Solar radiation: Investigations in solar radiation are conducted at Madison, Wis., Lincoln, Nebr., and Santa Fe., N. Mex., and the costs are stated in the expenditures listed under these stations. Accurate measurements of the heat that is obviously continuously received, day by day, from the sun and its possible variations are the fundamental data of all physical meteorology, since the heat from the sun is the primary source of all weather phenomena. This element is now subject to daily measurements. The improvement and extension of the observations are going forward steadily. (*d*) Evaporation: Evaporation investigations are conducted at Wagon Wheel Gap, Colo. They consist of the measurement of the evaporation of water from vegetation, the soil, and water surfaces in general, which will be of special application in connection with reclamation, irrigation, and water-power projects. (*e*) Seismology: Seismological investigations are conducted at San Francisco, Cal.; comprises the study of earthquake vibrations.

[Extension.]

Educational work.—Educational work comprises lectures and courses of instruction in meteorology given by Weather Bureau officials, often according to definite schemes of cooperation between universities, colleges, and other educational institutions and the local representatives of the Weather Bureau. In several cases the Weather Bureau occupies quarters in the institution concerned or its office building is located on the university campus. The services are rendered in most cases without additional compensation to the Weather Bureau official, but in some cases a nominal honorarium is tendered by the institution, and the services are performed without interference with the station work. No direct expenditure of Government funds is involved in any case.

DISTRIBUTION OF WORK BY STATIONS.

Location.	Character of work.	Cooperation.	Date begun.	Assignment.	Proposed expenditures, 1915-16.
Abilene, Tex	Meteorological observations and reports and daily weather forecasts.		1885	William H. Green	$2,300
Albany, N. Y	Meteorological observations and reports, daily weather forecasts, river and flood work.		1873	George T. Todd	7,100
Alpena, Mich	Meteorological observations and reports, daily weather forecasts, and maintenance of United States telegraph line.		1872	Frank Jermin	4,200
Amarillo, Tex	Meteorological observations and reports and daily weather forecasts.		1892	Thomas J. Considine.	3,500
Anniston, Ala	do		1905	Robert H. Dean	1,700
Asheville, N. C	do		1902	Thomas R. Taylor	3,500
Atlanta, Ga. (section center).	Meteorological observations and reports, daily weather forecasts, river and flood work, and climatological and crop work.		1878	Charles F. von Herrmann.	12,000
Atlantic City, N. J.	Meteorological observations and reports and daily weather forecasts.	Coast Guard Service.	1873	Levi A. Judkins	2,800
Augusta, Ga	Meteorological observations and reports, daily weather forecasts, river and flood work, and climatological and crop work.		1870	Eugene D. Emigh.	5,920
Baker, Oreg	Meteorological observations and reports and daily weather forecasts.		1911	John E. Hissong	1,420
Baltimore, Md. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and educational work.	Bureaus of Entomology and Plant Industry, Johns Hopkins University, Maryland Agricultural College, Mount St. Mary's College, and U. S. Naval Academy.	1871	Oliver L. Fassig	7,540
Bentonville, Ark	Meteorological observations and reports and daily weather forecasts.		1906	Orin Parker	1,500

DISTRIBUTION OF WORK BY STATIONS—Continued.

Location.	Character of work.	Cooperation.	Date begun.	Assignment.	Proposed expenditures, 1915-16.
Binghamton, N. Y.	Meteorological observations and reports, daily weather forecasts, and river and flood work.	....	1896	John R. Weeks....	$5,090
Birmingham, Ala..	Meteorological observations and reports and daily weather forecasts.	....	1903	Edgar C. Horton..	4,790
Bismarck, N. Dak. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and river and flood work.	Forest Service, Indian Service, University of North Dakota.	1874	Orris W. Roberts..	5,740
Block Island, R. I.	Meteorological observations and reports, daily weather forecasts, and maintenance of seacoast telegraph line.	....	1880	George W. Eddey.	2,050
Boise, Idaho (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and educational work.	Forest Service, Reclamation Service, Idaho Experiment Station, Indian Service, and University of Idaho.	1898	Edward L. Wells..	7,900
Boston, Mass. (section center).	.....do......................	Navy Department, Department of Commerce, Geological Survey, Bureau of Fisheries; Connecticut, Massachusetts, Maine, and New Hampshire Experiment Stations; Coast Guard Service, Blue Hill Observatory, Dartmouth College, Williams College, and Boston Yacht Club.	1870	John W. Smith...	19,800
Buffalo, N. Y......	Meteorological observations and reports, daily weather forecasts, and educational work.	Canisius College and Lackawanna Steel Co.	1870	David Cuthbertson.	12,880
Burlington, Vt....	.....do......................	University of Vermont.	1906	John K. Hooper...	4,600
Cairo, Ill...........	Meteorological observations and reports, daily weather forecasts, and river and flood work.	....	1871	Robert T. Lindley.	5,200
Canton, N. Y......	Meteorological observations and reports and daily weather forecasts.	....	1906	John S. Hazen....	2,600
Cape Henry, Va...	Meteorological observations and reports, daily weather forecasts, maintenance of seacoast telegraph line, and vessel reporting.	....	1873	John F. Newsom..	7,480
Charles City, Iowa.	Meteorological observations and reports and daily weather forecasts.	....	1904	Hal P. Hardin....	2,150
Charleston, S. C...	Meteorological observations and reports, daily weather forecasts, river and flood work, and climatological and crop work.	....	1871	James H. Scott....	7,800

DISTRIBUTION OF WORK BY STATIONS—Continued.

Location.	Character of work.	Cooperation.	Date begun.	Assignment.	Proposed expenditures, 1915-16.
Charlotte, N. C.	Meteorological observations and reports and daily weather forecasts.		1878	Ora O. Atto	$3,400
Chattanooga, Tenn.	Meteorological observations and reports, daily weather forecasts, and river and flood work.		1879	Lewis M. Pindell	8,600
Cheyenne, Wyo. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and educational work.	War Department, Forest Service, Reclamation Service, Wyoming Experiment Station, and University of Wyoming.	1870	Robert Q. Grant	6,480
Chicago, Ill. (district forecast center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and maintenance of United States telegraph line.	Coast Guard Service and Jackson Park Yacht Club.	1870	Henry J. Cox, Charles L. Mitchell.	44,710
Cincinnati, Ohio	Meteorological observations and reports, daily weather forecasts, and river and flood work.		1870	William C. Devereaux.	16,880
Cleveland, Ohio	Meteorological observations and reports, daily weather forecasts, and educational work.	Case Scientific School.	1870	William H. Alexander.	12,000
Columbia, Mo. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and educational work.	Missouri Experiment Station, University of Missouri, and Westminster College.	1889	George Reeder	5,400
Columbia, S. C. (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop, river and flood, and educational work.	Bureau of Plant Industry, Charleston Museum, Clemson College, and Winthrop College.	1887	Richard H. Sullivan.	5,990
Columbus, Ohio (section center).	do	Geological Survey, Coast Guard Service, Hiram College, Oberlin College, Ohio State University, Ohio Experiment Station, St. Ignatius College, and Urbana University.	1878	J. Warren Smith	15,000
Concord, N. H.	Meteorological observations and reports, daily weather forecasts, and river and flood work.		1902	Elisha C. Vose	3,660
Concordia, Kans.	Meteorological observations and reports and daily weather forecasts.		1885	John W. Byram	1,780
Corpus Christi, Tex.	do		1887	William F. Lehman.	3,880
Dallas, Tex	do		1913	Joseph L. Cline	5,890
Davenport, Iowa	Meteorological observations and reports, daily weather forecasts, and river and flood work.		1871	Julius M. Sherier	5,620
Dayton, Ohio	do		1911	R. Frank Young	6,450

DISTRIBUTION OF WORK BY STATIONS—Continued.

Location.	Character of work.	Cooperation.	Date begun.	Assignment.	Proposed expenditures, 1915-16.
Del Rio, Tex.	Meteorological observations and reports and daily weather forecasts.		1905	William U. Simons.	$1,850
Denver, Colo. (district forecast and section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop, river, and flood, and educational work.	Forest Service, Indian Office, Reclamation Service, Colorado Agricultural College, Arkansas Valley Experiment Station, and Colorado State College.	1871	Frederick H. Brandenburg, Frederick W. Brist.	22,560
Des Moines Iowa (section center).	do.	Iowa College and Experiment Station, Iowa State University, State Weather Service, and Tobin College.	1878	George M. Chappel.	7,430
Detroit, Mich.	Meteorological observations and reports and daily weather forecasts.		1870	Norman B. Conger.	11,980
Devils Lake N. Dak.	do.		1904	Martin R. Hovde.	1,980
Dodge City, Kans.	do.		1874	Harrison McP. Baldwin.	1,660
Drexel, Nebr.	Aerological observations.	United States Army.	1914	Bertram J. Sherry.	24,970
Dubuque, Iowa.	Meteorological observations and reports, daily weather forecasts, and river and flood work.		1873	James H. Spencer.	6,020
Duluth, Minn.	Meteorological observations and reports and daily weather forecasts.		1870	Herbert W. Richardson.	7,680
Eastport, Me.	do.		1873	Daniel C. Murphy.	2,340
Elkins, W. Va.	do.		1889	Harris A. Jones.	2,790
El Paso, Tex.	do.		1878	Nathan D. Lane.	3,890
Erie, Pa.	do.		1873	Harry O. Geren.	6,530
Escanaba, Mich.	do.		1898	Vincent E. Jakl.	2,890
Eureka, Cal.	do.	Coast Guard Service.	1886	Aaron H. Bell.	2,300
Evansville, Ind.	Meteorological observations and reports, daily weather forecasts, and river and flood work.		1897	Albert Brand.	5,780
Fort Smith, Ark.	do.		1882	Leon J. Guthrie.	5,160
Fort Wayne, Ind.	Meteorological observations and reports and daily weather forecasts.		1911	Patrick McDonough.	6,390
Fort Worth, Tex.	do.	Bureau of Plant Industry.	1898	Dennis S. Landis.	5,200
Fresno, Cal.	Meteorological observations and reports, daily weather forecasts, and river and flood work.		1887	Walter E. Bennett.	7,230
Galveston, Tex.	Meteorological observations and reports and daily weather forecasts.	Navy Department and St. Mary's University.	1871	William P. Stewart	5,600
Grand Haven, Mich.	do.		1905	William J. Schnurbusch.	2,980
Grand Junction, Colo.	do.		1899	Esek S. Nichols.	6,220

DISTRIBUTION OF WORK BY STATIONS—Continued.

Location.	Character of work.	Cooperation.	Date begun.	Assignment.	Proposed expenditures, 1915-16.
Grand Rapids, Mich. (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop, river and flood, and educational work.	Bureau of Plant Industry, Coast Guard Service, Michigan Experiment Station, and University of Michigan.	1903	Charles F. Schneider.	$8,240
Green Bay, Wis...	Meteorological observations and reports and daily weather forecasts.	....	1886	Frederick W. Conrad.	2,650
Hannibal, Mo.....	Meteorological observations and reports, daily weather forecasts, and river and flood work.	....	1892	Bion L. Waldron..	3,890
Harrisburg, Pa....	.....do....................	....	1888	Edward R. Demain.	5,060
Hartford, Conn....	.....do....................	....	1904	William W. Neifert.	6,590
Hatteras, N. C.....	Meteorological observations and reports, daily weather forecasts, and maintenance of seacoast telegraph line.	....	1874	Will L. Wyland...	2,280
Havre, Mont......	Meteorological observations and reports and daily weather forecasts.	....	1892	Charles W. Ling..	1,920
Helena, Mont. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and educational work.	Reclamation Service, Forest Service, Montana Agricultural College, Montana State University, and Montana Experiment Station.	1880	H. F. Alps........	8,880
Honolulu, Hawaii (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop work.	Navy Department, War Department, and Hawaii Experiment Station.	1904	William B. Stockman.	5,600
Houghton, Mich...	Meteorological observations and reports and daily weather forecasts.	....	1900	Howard B. Cowdrick.	3,500
Houston, Tex. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and river and flood work.	War Department, Bureau of Plant Industry, and Holiness University.	1909	Bernard Bunnemeyer.	16,690
Huron, S. Dak. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and educational work.	War Department, Forest Service, Indian Office, Reclamation Service, and South Dakota Experiment Station.	1881	Montello E. Blystone.	5,850
Indianapolis, Ind. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and river and flood work.	Indiana Experiment Station, Notre Dame University, and St. Joseph's College.	1871	John H. Armington.	12,660

DISTRIBUTION OF WORK BY STATIONS—Continued.

Location.	Character of work.	Cooperation.	Date begun.	Assignment.	Proposed expenditures, 1915-16.
Iola, Kans.	Meteorological observations and reports, daily weather forecasts, and river and flood work.	....	1905	Howard K. Holcomb.	$2,190
Ithaca, N. Y. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and educational work.	New York Experiment Station, West Point Military Academy, Coast Guard Service, Cornell University, and Ranger School.	1887	Wilford M. Wilson	7,020
Jacksonville, Fla. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and educational work.	Bureau of Plant Industry, Forest Service, Coast and Geodetic Survey, and University of Florida.	1871	Alexander J. Mitchell.	14,270
Kalispell, Mont.	Meteorological observations and reports and daily weather forecasts.	....	1899	Harvey B. Dick	2,040
Kansas City, Mo.	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and river and flood work.	....	1888	Patrick Connor	10,890
Keokuk, Iowa	Meteorological observations and reports, daily weather forecasts, and river and flood work.	....	1871	Frederic Z. Gosewisch.	2,520
Key West, Fla.	Meteorological observations and reports, daily weather forecasts, maintenance of seacoast telegraph line, and vessel reporting.	....	1870	Harry B. Boyer	9,050
Knoxville, Tenn.	Meteorological observations and reports, daily weather forecasts, and river and flood work.	....	1871	John F. Voorhees.	5,690
La Crosse, Wis.	.....do	....	1872	Edwin C. Thompson.	5,290
Lander, Wyo.	Meteorological observations and reports and daily weather forecasts.	....	1891	McLin S. Collom	1,400
Lansing, Mich.	Meteorological observations and reports, daily weather forecasts, and educational work.	....	1910	Dewey A. Seeley	4,480
Lewiston, Idaho	Meteorological observations and reports and daily weather forecasts.	....	1900	Walter W. Thomas.	2,570
Lexington, Ky.	.....do	....	1893	George B. Wurtz	4,490
Lincoln, Nebr. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, investigations in solar radiation, and educational work.	War Department, Forest Service, Reclamation Service, Indian Service, University of Nebraska, and Doane College.	1897	George A. Loveland.	8,510
Little Rock, Ark. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop, river and flood, and educational work.	War Department, Forest Service, Reclamation Service, and Arkansas Experiment Station.	1879	Harvey S. Cole	10,690

DISTRIBUTION OF WORK BY STATIONS—Continued.

Location.	Character of work.	Cooperation.	Date begun.	Assignment.	Proposed expenditures, 1915-16.
Los Angeles, Cal.	Meteorological observations and reports, daily weather forecasts, and educational work.	University of California and Los Angeles Chamber of Commerce.	1877	Ford A. Carpenter.	$11,670
Louisville, Ky. (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop, river and flood, and educational work.	Kentucky Experiment Station, Bethlehem Academy, University of Louisville, and Loretto Academy.	1871	Ferdinand J. Walz	13,980
Ludington, Mich.	Meteorological observations and reports and daily weather forecasts.	....	1912	Charles S. Wood.	3,300
Lynchburg, Va.	do	....	1871	George N. Wilson.	3,780
Macon, Ga.	Meteorological observations and reports, daily weather forecasts, and river and flood work.	....	1899	William A. Mitchell.	4,230
Madison, Wis.	Meteorological observations and reports, daily weather forecasts, investigations in solar radiation, and educational work.	University of Wisconsin.	1904	Eric R. Miller.	4,590
Marquette, Mich.	Meteorological observations and reports and daily weather forecasts.	....	1871	Henry R. Patrick.	3,200
Memphis, Tenn.	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and river and flood work.	....	1871	Samuel C. Emery.	8,540
Meridian, Miss.	Meteorological observations and reports, daily weather forecasts, and river and flood work.	....	1889	James H. Jaqua.	5,380
Miami, Fla.	Meteorological observations and reports and daily weather forecasts.	....	1911	Richard W. Gray.	4,850
Milwaukee, Wis. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and educational work.	Department of Commerce, Wisconsin Experiment Station, Carroll College, North Wisconsin Academy, Smith Observattory, and Ripon College.	1870	Henry B. Hersey.	13,870
Minneapolis, Minn. (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop, river and flood, and educational work.	Reclamation Service, Indian Service, and University of Minnesota.	1890	Ulysses G. Purssell.	12,560
Mobile, Ala.	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and river and flood work.	....	1870	Albert Ashenberger.	7,200
Modena, Utah.	Meteorological observations and reports and daily weather forecasts.	....	1901	William H. Hossler.	1,550
Montgomery, Ala. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and river and flood work.	Tuskegee Institute.	1872	Patrick H. Smyth.	7,340
Mount Weather, Va.	Meteorological observations.	....	1904	James E. Fowler.	2,450

DISTRIBUTION OF WORK BY STATIONS—Continued.

Location.	Character of work.	Cooperation.	Date begun.	Assignment.	Proposed expenditures, 1915-16.
Nantucket, Mass..	Meteorological observations and reports and daily weather forecasts.	....	1886	George E. Grimes.	$2,600
Narragansett Pier, R. I.	.....do........................	....	1882	Margaret E. Conway.	1,500
Nashville, Tenn. (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop, river and flood, and educational work.	Tennessee Experiment Station and University of the South.	1870	Roscoe Nunn.....	11,550
New Haven, Conn.	Meteorological observations and reports, daily weather forecasts, and educational work.	Yale University.	1872	Leonard M. Tarr..	7,580
New Orleans, La. (district forecast and section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop, river and flood, and educational work.	Bureau of Entomology, Louisiana Experiment Station, Loyola College, and St. Charles College.	1870	Isaac M. Cline.....	26,980
New York, N. Y..	Meterological observations and reports and daily weather forecasts.	Navy Department.	1870	James H. Scarr....	31,560
Norfolk, Va........	.....do........................	.....do........	1871	William G. Burns.	10,950
Northfield, Vt.....	Meteorological observations and reports, daily weather forecasts, and educational work.	Norwich University.	1887	William A. Shaw..	4,160
North Head, Wash.	Meteorological observations and reports, daily weather forecasts, and maintenance of seacoast telegraph line.	....	1902	John J. Kelliher...	1,570
North Platte, Nebr.	Meteorological observations and reports and daily weather forecasts.	....	1874	Alphonso W. Shilling.	3,770
Oklahoma, Okla. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and educational work.	Forest Service, Indian Office, University of Oklahoma, and Bacone College.	1890	J. Pemberton Slaughter.	11,390
Omaha, Nebr......	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and river and flood work.	....	1870	Lucius A. Welsh..	8,990
Oswego, N. Y.....	Meteorological observations and reports and daily weather forecasts.	....	1870	Julius G. Linsley..	1,900
Palestine, Tex.....	.....do........................	....	1881	Louis Dorman....	2,500
Parkersburg, W. Va. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and river and flood work.	University of West Virginia.	1881	Henry C. Howe...	5,450
Pensacola, Fla.....	Meteorological observations and reports and daily weather forecasts.	Coast Guard Service.	1879	William F. Reed, Jr.	6,020
Peoria, Ill.........	Meteorological observations and reports, daily weather forecasts, and educational work.	Bradley Polytechnic Institute.	1905	Merton L. Fuller..	6,560
Philadelphia, Pa. (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop, river and flood, and educational work.	Coast Guard Service, Moravian Parochial School, Pennsylvania State College, State Forestry Service, and Normal School.	1871	George S. Bliss....	16,300

DISTRIBUTION OF WORK BY STATIONS—Continued.

Location.	Character of work.	Cooperation.	Date begun.	Assignment.	Proposed expenditures, 1915-16.
Phoenix, Ariz. (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop, river and flood, and educational work.	Forest Service, Bureaus of Plant Industry and Entomology, Coast and Geodetic Survey, Indian Office, Reclamation Service, and Arizona Experiment Station.	1895	Robert R. Briggs..	$7,580
Pierre, S. Dak.....	Meteorological observations and reports and daily weather forecasts.	....	1891	Edwin E. Row...	1,330
Pittsburgh, Pa....	Meteorological observations and reports, daily weather forecasts, and river and flood work.	....	1870	Henry Pennywitt.	15,490
Pocatello, Idaho...	Meteorological observations and reports and daily weather forecasts.	....	1899	Arthur R. Teeple..	1,560
Port Crescent, Wash.	Meteorological observations and reports, daily weather forecasts, maintenance of seacoast telegraph line, and vessel reporting.	....	1898	Leon G. Sutton...	8,920
Port Huron, Mich.	Meteorological observations and reports and daily weather forecasts.	....	1874	Abe Wiesner......	2,230
Portland, Me......	Meteorological observations and reports, daily weather forecasts, and river and flood work.	....	1871	Edward P. Jones..	6,400
Portland, Oreg. (district forecast and section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop, river and flood, and educational work.	Forest Service, Geological Survey, Coast Guard Service, Reclamation Service, Oregon Agricultural College, Oregon Experiment Station, and University of Oregon.	1871	Edward A. Beals..	29,480
Providence, R. I...	Meteorological observations and reports and daily weather forecasts.	Ladd Observatory.	1904	Eben H. Emery...	7,190
Pueblo, Colo......	.....do............	....	1888	Lawrence H. Daingerfield.	4,090
Raleigh, N. C. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and river and flood work.	Bureau of Fisheries and North Carolina Experiment Station.	1884	Lee A. Denson....	11,880
Rapid City, S. Dak.	Meteorological observations and reports and daily weather forecasts.	....	1888	Harley N. Johnson	2,060
Reading, Pa......	.....do............	....	1912	Cornelius J. Doherty.	4,780
Red Bluff, Cal.....	Meteorological observations and reports and daily weather forecasts.	....	1877	Noble M. Cunningham.	2,860

DISTRIBUTION OF WORK BY STATIONS—Continued.

Location.	Character of work.	Cooperation.	Date begun.	Assignment.	Proposed expenditures, 1915-16.
Reno, Nev. (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop work.	Forest Service, Reclamation Service, Indian Service, and Nevada Experiment Station.	1905	Henry F. Alciatore.	$5,960
Richmond, Va. (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop, river and flood, and educational work.	Bureau of Plant Industry, Virginia Experiment Station, Leander McCormick Observatory, Normal and Agricultural Institute, Virginia Military Institute, and Norfolk & Western Ry. Experiment Station.	1897	Edward A. Evans.	8,390
Rochester, N. Y...	Meteorological observations and reports and daily weather forecasts.	....	1870	Luther M. Dey....	4,680
Roseburg, Oreg....	.....do.....................	....	1877	William Bell......	2,880
Roswell, N. Mex..	.....do.....................	....	1904	Cleve Hallenbeck..	1,530
Sacramento, Cal...	Meteorological observations and reports, daily weather forecasts, and river and flood work.	....	1877	Nathaniel R. Taylor.	6,790
Saginaw, Mich.....	Meteorological observations and reports, daily weather forecasts, and river and flood and educational work.	Arthur Hill Trade School	1912	Frank H. Coleman	3,930
St. Joseph, Mo.....	Meteorological observations and reports and daily weather forecasts.	....	1910	William S. Belden	5,360
St. Louis, Mo......	Meteorological observations and reports, daily weather forecasts, and climatological and crop, river and flood, and educational work.	St. Louis University.	1870	Montrose W. Hayes.	20,000
St. Paul, Minn....	Meteorological observations and reports and daily weather forecasts.	....	1870	John N. Ryker....	5,520
Salt Lake City, Utah (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop, river and flood, and educational work.	Bureau of Plant Industry, Forest Service, Reclamation Service, Indian Service, Utah Experiment Station, University of Utah, and Murdock Academy.	1874	Alfred H. Thiessen.	11,910
San Antonio, Tex..	Meteorological observations and reports and daily weather forecasts.	....	1885	Allen Buell.......	6,050
San Diego, Cal.....	.....do.....................	Navy Department.	1871	E. Herbert Nimmo	4,840
Sandusky, Ohio...	.....do.....................	....	1877	Claude C. Cooper..	4,630
Sandy Hook, N. J..	Meteorological observations and reports and daily weather forecasts.	....	1914	Marsden Wright..	9,590

DISTRIBUTION OF WORK BY STATIONS—Continued.

Location.	Character of work.	Cooperation.	Date begun.	Assignment.	Proposed expenditures, 1915-16.
San Francisco, Cal. (district forecast and section center).	Meteorological observations and reports, daily weather forecasts, educational work, and maintenance of seacoast telegraph line.	Navy Department, Bureaus of Plant Industry and Entomology, Forest Service, Indian Service, Geological Survey, California Experiment Station, Chabot Observatory, and Santa Clara College.	1871	George H. Willson.	$35,490
San Jose, Cal.	Meteorological observations and reports and daily weather forecasts.	....	1905	Maurice Connell.	1,640
San Juan, P. R., W. I. (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop work.	Navy Department, Irrigation Service, and Porto Rico Experiment Station.	1898	F. Eugene Hartwell.	4,340
San Luis Obispo, Cal.	Meteorological observations and reports and daily weather forecasts.	....	1894	John R. Williams.	1,670
Santa Fe, N. Mex. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, investigations in solar radiation, and educational work.	Forest Service, Reclamation Service, New Mexico Agricultural College, New Mexico Experiment Station, and Rio Grande Industrial School.	1871	Charles E. Linney.	5,850
Sault Ste. Marie, Mich.	Meteorological observations and reports and daily weather forecasts.	....	1877	Alexander G. Burns.	3,670
Savannah, Ga.	Meteorological observations and reports, daily weather forecasts, and climatological and crop work.	....	1871	Charles M. Strong.	9,420
Scranton, Pa.	Meteorological observations and reports and daily weather forecasts.	....	1900	William M. Dudley.	4,690
Seattle, Wash. (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop and educational work.	War and Navy Departments, Department of Justice, Bureau of Plant Industry, Forest Service, Geological Survey, Bureau of Fisheries, Reclamation Service, Coast Guard Service, Alaska Experiment Station, and Washington Agricultural College, Experiment Station, and State University.	1893	George N. Salisbury.	14,940

DISTRIBUTION OF WORK BY STATIONS—Continued.

Location.	Character of work.	Cooperation.	Date begun.	Assignment.	Proposed expenditures, 1915–16.
Sheridan, Wyo	Meteorological observations and reports and daily weather forecasts.		1907	Harry A. Frise	$2,470
Shreveport, La	Meteorological observations and reports, daily weather forecasts, and river and flood work.		1871	James W. Cronk	4,880
Sioux City, Iowa	do		1889	Gilbert W. McDowall.	3,820
Spokane, Wash	Meteorological observations and reports and daily weather forecasts.		1881	Charles Stewart	5,090
Springfield, Ill. (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop and educational work.	Blackburn College, Ewing College, Illinois State Normal University, Elgin Observatory, West Illinois Normal School, and University of Illinois.	1879	Clarence J. Root	8,610
Springfield, Mo	Meteorological observations and reports, daily weather forecasts, and educational work.	Drury College.	1887	Walter B. Hare	4,220
Syracuse, N. Y	do	State College of Forestry and Syracuse University.	1902	Morgan R. Sanford.	4,920
Tacoma, Wash	Meteorological observations and reports and daily weather forecasts.		1897	Louis C. Cover	4,520
Tampa, Fla	do		1890	Walter J. Bennett.	5,850
Tatoosh Island, Wash.	Meteorological observations and reports, daily weather forecasts, maintenance of seacoast telegraph line, and vessel reporting.		1902	Ralph C. Mize	2,930
Taylor, Tex	Meteorological observations and reports and daily weather forecasts.		1901	Herbert Tullsen	2,980
Terre Haute, Ind	Meteorological observations and reports, daily weather forecasts, and river and flood work.		1912	William R. Cade	6,890
Thomasville, Ga	Meteorological observations and reports and daily weather forecasts.		1905	Olin M. Hadley	2,270
Toledo, Ohio	do		1870	William S. Currier.	5,680
Tonopah, Nev	do		1906	Hugo Legler	2,580
Topeka, Kans. (section center).	Meteorological observations and reports, daily weather forecasts, climatological and crop work, and educational work.	Kansas Agricultural College and Kansas Wesleyan University.	1887	Thorp B. Jennings	5,410
Trenton, N. J. (section center).	do	New Jersey Agricultural College and Experiment Station.	1913	G. Harold Noyes	8,470
Valentine, Nebr	Meteorological observations and reports and daily weather forecasts.		1885	Louis Lodholz	1,880
Vicksburg, Miss. (section center).	Meteorological observations and reports, daily weather forecasts, and climatological and crop, river and flood, and educational work.	Bureau of Fisheries and Agricultural College and University of Mississippi.	1871	William E. Barron.	8,550

DISTRIBUTION OF WORK BY STATIONS—Continued.

Location.	Character of work.	Cooperation.	Date begun.	Assignment.	Proposed expenditures, 1915-16.
Wagon Wheel Gap, Colo.	Meteorological observations and reports and climatological work.	Forest Service.	1910	Thomas A. Blair..	$4,180
Walla Walla, Wash.	.....do.....................	....	1885	Charles C. Garrett.	3,680
Wausau, Wis.......	.....do.....................	....	1915	Ellwood E. Unger.	2,000
Wichita, Kans.....	Meteorological observations and reports, daily weather forecasts, and river and flood work.	....	1888	Samuel P. Peterson.	5,580
Williston, N. Dak.	Meteorological observations and reports and daily weather forecasts.	....	1893	John Craig........	1,800
Wilmington, N. C.	Meteorological observations and reports, daily weather forecasts, and climatological and crop work.	Coast Guard Service.	1871	George W. Felger.	4,100
Winnemucca, Nev.	Meteorological observations and reports and daily weather forecasts.	....	1884	Ray L. Fisher.....	1,610
Wytheville, Va....	.....do.....................	....	1902	James I. Widmeyer.	1,770
Yankton, S. Dak..	.....do.....................	....	1873	William H. Fallon	1,680
Yellowstone Park, Wyo.	.....do.....................	....	1903	William D. Maxwell.	2,180
Yuma, Ariz.......	.....do.....................	....	1875	Sumner Hackett..	1,340
Alaskan stations...	Meteorological observations and reports.	....	1899	7 observers.......	2,500
West Indian stations and foreign service.	.....do.....................	....	1898	9 observers.......	18,000
United States......	Administrative and other travel in connection with inspection of stations and other routine work of the central office and the Washington station.	....	1891	C. F. Marvin, E. H. Bowie, H. C. Frankenfield, and others.	3,000
Total, Weather Bureau Stations.	....	....	......	....	[1] 1,318,510

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[1] Service, $1,289,510; research, $29,000.

BUREAU OF ANIMAL INDUSTRY.

ADMINISTRATION.

General Administration:

Object.—Supervision of the bureau activities and the performance of such duties as are common to the bureau as a whole, the cost of which can not be readily prorated against the various projects involved, such as accounting and editorial work, the distribution of supplies, and matters relating to the personnel.

Location.—Washington, D. C.

Date begun.—1884.

Assignment.—A. D. Melvin, J. R. Mohler, C. C. Carroll.

Proposed expenditures, 1915–16.—$123,000.

Stores:

Object.—To provide for miscellaneous supplies, the use of which is more or less common to the various laboratories and offices of the bureau, and which are purchased from time to time and held in stock to be distributed as may be required in connection with the various projects.

Location.—Washington, D. C.

Date begun.—1884.

Assignment.—A. D. Melvin, J. R. Mohler, C. C. Carroll.

Proposed expenditures, 1915–16.—$50,000.

Total, Administration, $173,000 (research, $35,000; regulation, $123,000; extension, $15,000).

CONTROL OF MEAT AND MEAT FOOD PRODUCTS.

Supervision:

Object.—Supervision of all the work of meat inspection, including the direction of some 2,500 employees at all the slaughtering centers of the United States, and the performance of duties common to the whole work.

Location.—Washington, D. C.

Date begun.—1891.

Assignment.—R. P. Steddom, M. Dorset, A. Eichhorn, B. H. Ransom.

Proposed expenditures, 1915–16.—$61,000 (research, $500; regulation, $60,500).

[Research.]

Bacteriological Investigations of Meat and Meat Food Products:

Object.—To develop information concerning various phases of preparing meat and meat food products.

Location.—Washington, D. C.

Date begun.—1907.

Results.—The cause of ham souring has been worked out and suggestions offered for its prevention. The reliability of the hot-room test as a means of detecting defective cans has been established and regulations governing the reprocessing of such cans adopted. The canning of sausage in oil has been investigated, and as a result regulations governing the preparation of this product have been adopted. The bacteria in the carcasses of hog-cholera hogs have been studied, with the result that no organisms of *Bacillus enteritidis*, or meat-poisoning type, were encountered. A bacteriological investigation of beef-ham pickles has been made, and as a result the use of these pickles in the manufacture of meat extracts has been prohibited. The process of dehairing and washing hog carcasses has been investigated, and it has been found that under certain conditions hair and dirty wash water entered the wound in the neck and penetrated through the blood vessels as far as the liver. Instructions were issued with a view to preventing this trouble. Reports have been made on the routine examination of meat samples, including

Bacteriological Investigations of Meat and Meat Food Products—Continued.
(1) samples suspected of having caused meat poisoning; (2) samples which have undergone putrefactive changes such as would render them unfit for food; (3) samples showing various discolorations due to molds and other causes.

Assignment.—C. N. McBryde.

Proposed expenditures, 1915–16.—$3,500.

Investigation of Changes in Fresh Meats in Cold Storage:

Object.—To ascertain, through bacteriological and chemical studies, the changes which take place in fresh beef stored under varying conditions and for varying lengths of time at temperatures above freezing; also to develop other information concerning the behavior of fresh meats in storage.

Location.—Washington, D. C., and certain other cities where meat-inspection establishments under Government inspection are located.

Date begun.—1913.

Assignment.—C. N. McBryde, Ralph Hoagland.

Proposed expenditures, 1915–16.—$5,000.

Investigation of Canned Meats:

Object.—To develop, through chemical and bacteriological studies, information concerning the effect which prolonged storage has upon canned meats.

Location.—Washington, D. C., and certain cities where meat-inspection establishments are operating under supervision of the Federal Government.

Date begun.—1909.

Assignment.—T. M. Price, C. N. McBryde.

Proposed expenditures, 1915–16.—$4,000.

Investigation of Pathological Conditions Noted during Meat Inspection:

Object.—The investigation of any abnormal, unusual, or hitherto unnoted condition of interest, directly or indirectly, from the meat inspection viewpoint, which may be encountered during routine Federal meat inspection. Special emphasis is laid upon infectious conditions and those characterized by malignancy.

Procedure.—Bacteriological examination in the fresh state by means of unstained and stained smears, as well as culture sowings from the tissue under investigation, for the purpose of demonstrating or eliminating material of an infectious nature and likewise differentiating and recovering, where possible, the causative agent. Preparation of the suspected material by freezing or other hardening methods, so that the tissue involved may be sectioned and studied microscopically in regard to their histologic structure for the recognition of any deviations from the normal that may be present.

Location.—Washington, D. C.: Chicago, Ill.; and South Omaha, Nebr.

Date begun.—1906.

Results.—Pathological conditions of puzzling character are frequently discovered during meat inspection. The study of these is of great assistance in the disposition of the carcasses affected.

Assignment.—H. J. Washburn, L. E. Day, G. B. Morse.

Proposed expenditures, 1915–16.—$9,500.

Investigations upon the Control of the House Fly and Other Insects in Establishments Operating under Federal Meat Inspection:

Object.—To devise plans for the control and eradication of the house fly and other insects in establishments operating under Federal meat inspection.

Procedure.—Study of conditions in establishments and surroundings with reference to the fly problem; experiments in the control and eradication of flies to be carried out in establishments at Dallas, Tex., and elsewhere.

Cooperation.—Bureau of Entomology.

Location.—Washington, D. C.; Dallas, Tex.; and various meat-inspection stations.

Date begun.—1915.

Probable date of completion.—1918.

Assignment.—G. H. Shaw.

Proposed expenditures, 1915–16.—$1,000.

[Regulation.]

Preparation and Distribution of Branding Ink:

Object.—To furnish bureau employees engaged in the work of meat inspection with a suitable marking fluid for stamping carcasses of animals inspected and slaughtered under Federal supervision.

Procedure.—The branding ink is prepared in the laboratories in Washington and shipped by freight to inspectors in charge of meat inspection upon request.

Location.—Washington, D. C.

Date begun.—1906.

Results.—During the fiscal year 1914 there were manufactured and forwarded to bureau stations 4,830 gallons of this ink for marking carcasses of animals.

Assignment.—J. A. Emery.

Proposed expenditures, 1915–16.—$3,600.

Special Supervisory Inspection:

Object.—To see that the law, regulations, and instructions governing meat inspection are properly observed.

Procedure.—Personal investigations are made of official establishments and of the conduct and inspection of operations.

Location.—Washington, D. C.; Chicago, Ill.; Nashville, Tenn.; Philadelphia, Pa.; and Portland, Oreg.—official stations of the traveling veterinary inspectors, bureau architect, and sanitary engineer.

Date begun.—1906.

Results.—More uniform inspection, increased efficiency, and better sanitary conditions.

Assignment.—R. P. Steddom, George Ditewig, A. J. Pistor.

Proposed expenditures, 1915–16.—$43,500.

Meat-Inspection Brands:

Object.—To provide brands used for marking carcasses, parts of carcasses, and containers of meat and meat food products, including imported meat and meat products.

Location.—Washington, D. C.

Date begun.—1906.

Assignment.—W. H. Smith.

Proposed expenditures, 1915–16.—$6,000.

Special Laboratory Inspection and Examination:

Object.—To ascertain whether meat and meat food products prepared in official establishments or under exemption or those shipped interstate by farmers, as well as imported meats and meat food products, are properly labeled, sound, healthful, wholesome, and otherwise fit for human food, and to determine whether any prohibited substance has been used in their preparation or in and about the establishment; also to determine whether the water and ice used in the preparation of meat and meat food products are potable.

Procedure.—Samples of all meat, meat food products, and ingredients used in their preparation are collected and submitted to chemical, physical, microscopical, and bacteriological examinations. A chemical and bacteriological examination is made of samples of all waters and ice used in the preparation of meat and its products. Examinations are also made of various preparations used in and about establishments.

Cooperation.—Bureau of Chemistry.

Location.—Washington, D. C.

Date begun.—1906.

Results.—The total number of samples examined during the fiscal year 1914 was 8,086, of which 825 were found to be violations; 261 samples of water examined and 12 water supplies condemned.

Assignment.—T. M. Price.

Proposed expenditures, 1915–16.—$17,500.

Ante-Mortem Inspection of Animals for Slaughter:

Object.—To discover animals which show symptoms of or are suspected of being affected with any disease or condition which would probably cause their condemnation in whole or in part when slaughtered, and to hold

Ante-Mortem Inspection of Animals for Slaughter—Continued.

such animals apart and slaughter them separately from other animals so as to insure careful post-mortem inspection as provided in the regulations governing Federal meat inspection.

Procedure.—An ante-mortem inspection and examination is made of all cattle, sheep, swine, and goats before they are slaughtered in an official establishment. This consists of visual and digital examinations and, when necessary, recording the temperatures of these animals.

Cooperation.—This work is conducted in cooperation with the State and local authorities at a few points.

Location.—Washington, D. C., and 146 cities, more or less, throughout the United States at which leaders are stationed. (See list of stations, which follows.)

Date begun.—1906.

Results.—During the fiscal year 1914 there were inspected 57,033,401 animals, of which 174,373 were marked as "suspects." Data in 1914 annual report of the Bureau of Animal Industry.

Assignment.—R. P. Steddom, George Ditewig, A. J. Pistor. (See also list of stations, which follows.)

Proposed expenditures, 1915–16.—$190,000.

Post-Mortem Inspection of Animals:

Object.—To make a careful examination and inspection of the carcasses and parts of all cattle, sheep, swine, and goats slaughtered at official establishments to determine the presence in any such carcasses or parts of any lesions of disease or other condition which might render the meat or any organ unfit for food purposes; and to condemn and to cause to be destroyed for food purposes all carcasses or parts thereof of animals found on final inspection to be unsound, unhealthful, unwholesome, or otherwise unfit for human food.

Procedure.—Visual and digital examinations are made, and, where necessary, the lymphatic glands, organs, or parts are incised.

Cooperation.—This work is conducted in cooperation with the State and local authorities at a few places.

Location.—Washington, D. C., and 146 cities, more or less, throughout the United States at which leaders are stationed. (See list of stations, which follows.)

Date begun.—1906.

Results.—During the fiscal year 1914 there were inspected 56,909,387 animals, of which 56,473,138 were passed as suitable for food purposes, 154,946 for lard or tallow, and 281,303 condemned and destroyed as unfit for food purposes.

Assignment.—R. P. Steddom, George Ditewig, A. J. Pistor. (See also list of stations, which follows.)

Proposed expenditures, 1915–16.—$1,225,000.

Supervision of the Preparation and Distribution of Meats:

Object.—To inspect meat and meat food products prepared within and brought into official establishments and departments thereof to see that no unfit meat or product is used in the various processes of preparation, packing, salting, smoking, canning, etc., to insure proper labeling, and to see that establishments are maintained in a sanitary condition, that the workers are clean as to person and raiment, and that deleterious preservatives or ingredients are not used; and otherwise to enforce compliance with the meat-inspection law and regulations.

Procedure.—All meats, before entering into the preparation of the various products, are examined and inspected physically to see that they are sound, healthful, wholesome, and fit for human food, and that they have been "United States inspected and passed." Each stage in the preparation of the various products is supervised to insure that it is performed under approved sanitary conditions, the products in course of preparation being frequently reinspected in order that no product may be allowed to enter into human consumption which has become unsound, unhealthful, unwholesome, or otherwise unfit for food purposes, or which contains any deleterious dye, chemical, preservative, or other ingredient which would render such product unfit for human food.

Location.—Washington, D. C., and 120 cities, more or less, in which leaders are stationed. (See list of stations, which follows.)

Supervision of the Preparation and Distribution of Meats—Continued.

Date begun.—1906.

Results.—During the fiscal year 1914 the work represented inspections equivalent to 7,033,295,975 pounds of meat and products thereof, of which 19,135,469 pounds were condemned as unfit for human food.

Assignment.—R. P. Steddom, George Ditewig, A. J. Pistor. (See also list of stations, which follows.)

Proposed expenditures, 1915–16.—$1,340,000.

Inspection of Meats for the United States Navy:

Object.—To insure that the meat and meat food products furnished the Navy have been inspected and passed and are so marked, that they are sound and fit for food purposes at the time of delivery, and that such articles conform to the specifications of the Navy.

Procedure.—The preparation of meat and meat food products for the Navy in accordance with special specifications is supervised to insure that such specifications are met. This supervision includes methods of curing, processing, and handling the articles. Reinspections are made when the articles are delivered to ships, navy yards, and other naval institutions, to see that they conform to the specifications and are sound and in every way fit for food.

Cooperation.—Bureau of Supplies and Accounts of the Navy Department.

Location.—Washington, D. C.; Baltimore, Md.; Boston, Mass.; New York and Brooklyn, N. Y.; Kansas City, Mo.; Natchez, Miss.; New Orleans, La.; Norfolk, Va.; Pensacola, Fla.; Philadelphia, Pa.; Portland, Oreg.; Newport and Providence, R. I.; Los Angeles, San Diego, and San Francisco, Cal.; and Seattle, Wash.

Date begun.—1907.

Results.—During the fiscal year 1914 meat and meat food products inspected for the United States Navy amounted to 15,565,952 pounds, of which 510,210 pounds were rejected.

Assignment.—R. P. Steddom, George Ditewig, A. J. Pistor.

Proposed expenditures, 1915–16.—$7,000 (to be reimbursed by the Navy Department).

Inspection at Public Markets:

Object.—To provide for the interstate transportation or export from public markets of portions of inspected and passed meats and products thereof which, when cut or otherwise removed from a marked carcass, part, or container, do not show the inspection legend.

Procedure.—The unmarked portions of meats cut from a properly marked carcass or meat food products removed from a properly marked container in the presence of a bureau inspector are examined by him and, if found to be sound, healthful, wholesome, and fit for human food, are marked with the inspection legend.

Location.—Washington, D. C., and 44 cities, more or less, in which leaders are stationed. (See list of stations, which follows.)

Date begun.—1908.

Assignment.—R. P. Steddom, George Ditewig, A. J. Pistor.

Proposed expenditures, 1915–16.—$15,200.

Supervision of Operations Conducted under Certificates of Exemption:

Object.—To ascertain whether or not shippers are in reality retail butchers, retail dealers, or farmers; also to see that the premises in which animals are slaughtered or where meat and meat food products are prepared by or for persons who make interstate shipments under exemption from inspection are maintained in a sanitary condition, and that the articles so shipped are sound, healthful, wholesome, and fit for human food.

Procedure.—The inspectors visit and examine the premises and ascertain the character of the business of the shipper. If the provisions of the regulations are met, numbered certificates of exemption are issued. These certificates are required in connection with the interstate transportation of meat and meat food products. In case the holder of a certificate of exemption fails to conform to the regulatoins, his certificate is revoked.

Cooperation.—State officials having jurisdiction over meat and its products within the State.

Location.—Washington, D. C., and 222 cities, more or less, in which leaders are stationed. (See list of stations, which follows.)

Supervision of Operations Conducted under Certificates of Exemption—Con.

Date begun.—1906.

Results.—At the close of the fiscal year 1914 there were 1,927 exemption certificates outstanding. During that year 114,976 shipments were made by retail butchers under authorization of the certificate of exemption.

Assignment.—R. P. Steddom, W. H. Smith.

Proposed expenditures, 1915–16.—$12,000.

Examination of Imported Meats and Meat Food Products:

Objects.—To prevent the importation of meat and meat food products of cattle, sheep, swine, and goats which are not properly certified, or which are falsely labeled, or which are unsound, unhealthful, unwholesome, or otherwise unfit for human food, or which contain any prohibited dye, chemical, preservative, or other harmful ingredients.

Procedure.—The foreign certificates of all shipments of meat and products offered for importation are examined to see that they conform to the department regulations. The meat and meat food products are carefully inspected and examined. Samples of consignments are given chemical examination. Only such products are admitted as are sound, healthful, wholesome, and fit for human food, are free from prohibited dye, chemicals, preservatives, and other harmful ingredients, and are properly labeled.

Cooperation.—Treasury Department and, in certain instances, the Bureau of Chemistry.

Location.—Washington, D. C., and 61 cities, more or less, in which inspection of imported meats and meat food products embraced under this project is made.

Date begun.—1913.

Results.—For the nine months of the fiscal year 1914 during which the tariff act of October 3, 1913, was effective 197,389,348 pounds of meat and meat food products from foreign countries were examined, of which 551,859 pounds were rejected.

Assignment.—R. P. Steddom, W. H. Smith.

Proposed expenditures, 1915–16.—$50,000.

Field Laboratory Inspection and Examination:

Object.—To ascertain whether meat and its products prepared in official establishments, or under exemption, or those shipped interstate by farmers, as well as imported meat and its products, are properly labeled, sound, healthful, wholesome, and otherwise fit for human food, and to determine whether any prohibited substance has been used in their preparation.

Procedure.—Samples of meat and products and ingredients used in their preparation are collected and submitted to chemical, physical, and microscopical examinations.

Cooperation.—Bureau of Chemistry.

Location.—New York, N. Y.; Chicago and East St. Louis, Ill.; South Omaha, Nebr.; Kansas City, Mo.; and San Francisco, Cal.

Date begun.—1906.

Results.—The number of samples examined during the fiscal year 1914 aggregated 23,502, of which 886 were found to be violations.

Assignment.—T. M. Price.

Proposed expenditures, 1915–16.—$72,000.

Miscellaneous Meat Inspection:

Object.—To cover minor activities not included under other projects of this group.

Procedure.—Various minor transactions incidental to the maintenance of meat inspection at 228, more or less, cities in the field, the transfer of employees between stations, and other miscellaneous items which are common to the control of meats and products thereof at such cities.

Location.—At 228 cities and towns, more or less, throughout the United States.

Date begun.—1891.

Assignment.—See list of stations, which follows.

Proposed expenditures, 1915–16.—$376,161.

Total, Control of Meat and Meat Food Products, $3,441,961 (research, $23,500; regulation, $3,418,461).

MEAT-INSPECTION STATIONS.

Location.	Character of work.	Date begun.	Assignment.	Proposed expenditures, 1915–16.
Albany, N. Y.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1909	E. H. Baumann	$6,290
Albert Lea, Minn.	do	1914	J. D. Stillwell	6,700
Alexandria, Va.	Preparation and shipping, miscellaneous.	1910		1,200
Allentown, Pa.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	N. C. Powell	7,764
Alton, Ill.	do	1906	Jas. Johnston	4,104
Arabi, La.	Ante-mortem, post-mortem, preparation and shipping.	1906		3,900
Arcata, Cal.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous.	1914		1,900
Arkansas City, Kans.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	J. E. Shelton	3,030
Ashland, Ky.	Preparation and shipping, miscellaneous.	1914		1,300
Atlantic, Iowa	Ante-mortem, post-mortem, miscellaneous.	1914		1,600
Auburn, Me.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	I. K. Green	3,208
Auburn, Mass.	Preparation and shipping, miscellaneous, and exemption work.	1906		1,225
Augusta, Ga.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, exemption work, and market inspection.	1908	J. E. Lovejoy	2,141
Austin, Minn.	do	1901	J. Miller	13,240
Austin, Tex.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous.	1906		900
Baltimore, Md.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, Navy inspection, import meats, public markets, and exemption work.	1904	H. A. Hedrick	40,505
Bayonne, N. J.	Preparation and shipping, miscellaneous.	1908		1,200
Beaumont, Tex.	do	1908		1,260
Beaver Falls, Pa.	Preparation and shipping, miscellaneous, public markets, and exemption work.	1909		675
Belmont, Mass.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous.	1906		1,000
Bellows Falls, Vt.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1912	T. W. Carnachan	2,001
Benning, D. C.	Ante-mortem, post-mortem, and preparation and shipping.	1906		3,200
Binghamton, N. Y.	Preparation and shipping, miscellaneous, and public markets.	1906		1,400
Boston, Mass.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, Navy inspection, public markets, and exemption work.	1895	J. F. Ryder	50,897
Bradford, Pa.	Preparation and shipping, miscellaneous, and exemption work.	1908		1,260
Bridgeport, Conn.	Preparation and shipping, miscellaneous, and import meats.	1909	J. F. Riemer	1,354
Bridgeport, Pa.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906		2,100
Brighton, Mass.	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1897		9,700
Brightwood, Mass.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, and exemption work.	1900	H. E. Brown	11,739
Brockton, Mass.	Preparation and shipping	1910		1,225
Brooklyn, N. Y.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, Navy inspection, public markets, and exemption work.	1895	A. Long	38,645
Buffalo, N. Y.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, public markets, and exemption work.	1892	B. P. Wende	69,578
Burlington, Vt.	Ante-mortem, post-mortem, preparation and shipping, import meats, and exemption work.	1906	C. C. Conley	1,819
Cambridge, Mass.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous.	1893		2,000
Camden, N. J.	Preparation and shipping, miscellaneous.	1906		1,200
Canajoharie, N. Y.	do	1906		1,347

MEAT-INSPECTION STATIONS—Continued.

Location.	Character of work.	Date begun.	Assignment.	Proposed expenditures, 1915-16.
Cedar Rapids, Iowa	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1896	F. Jelen	$22,080
Central Falls, R. I	Preparation and shipping, miscellaneous.	1906		1,200
Charleston, Tenn	Ante-mortem, post-mortem, preparation and shipping, miscellaneous.	1907		300
Chattanooga, Tenn	Preparation and shipping, miscellaneous.	1911		1,300
Chester, Pa	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906		4,000
Cheyenne, Wyo	do	1907	A. T. Knowles	3,486
Chicago, Ill	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, public markets, exemption work, and laboratory meat inspection.	1891	W. N. Neil	503,749
Chicopee, Mass	Ante-mortem, post-mortem, preparation and shipping, miscellaneous.	1906		1,200
Cincinnati, Ohio	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, exemption work, and import meats.	1895	D. C. Burnett	80,351
Circleville, Ohio	Preparation and shipping, miscellaneous.	1909		25
Clarkston, Wash	Ante-mortem, post-mortem, preparation and shipping.	1907		1,800
Cleveland, Ohio	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, public markets, and exemption work.	1892	H. H. George	66,635
Columbus, Ohio	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	O. W. Everly	5,550
Corning, N. Y	Preparation and shipping, miscellaneous, and exemption work.	1906		500
Cortland, N. Y	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, and exemption work.	1906	A. F. Staub	3,920
Cudahy, Wis	Ante-mortem, post-mortem, preparation and shipping, miscellaneous.	1891		21,600
Cumberland, Md	Preparation and shipping, miscellaneous, and exemption work.	1908	J. C. Shafer	1,320
Dallas, Tex	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1906		4,900
Davenport, Iowa	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, public markets, and exemption work.	1896	J. W. Joss	5,040
Dayton, Ohio	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	F. L. Gardner	12,501
Denver, Colo	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, exemption work, and public markets.	1903	J. C. Exline	32,844
Detroit, Mich	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, public markets, and exemption work.	1899	E. P. Schaffter	28,988
Dover, Del	Preparation and shipping, miscellaneous.	1906		400
Dover, N. J	do	1910		1,225
Dubuque, Iowa	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	W. C. Bower	3,280
Duluth, Minn	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, and exemption work.	1906	E. S. Dickey	4,217
East Deering, Me	Preparation and shipping, miscellaneous.	1906		1,380
East Liverpool, Ohio	do	1914		675
Easton, Pa	do	1914		800
Eau Claire, Wis	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1899	W. Fotheringham.	4,416
Elgin, Ill	Preparation and shipping	1914		1,260
Elmira, N. Y	Preparation and shipping, miscellaneous.	1908		860
El Paso, Tex	Preparation and shipping, miscellaneous, import meats, and exemption work.	1907	C. T. Bertrand	5,400
Eola, Ill	Preparation and shipping, miscellaneous.	1906		500
Erie, Pa	do	1911		1,300
Evansville, Ind	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	L. Metsker	5,760
Fall River, Mass	Preparation and shipping, miscellaneous and exemption work.	1906		2,000

MEAT-INSPECTION STATIONS—Continued.

Location.	Character of work.	Date begun.	Assignment.	Proposed expenditures, 1915–16.
Fargo, N. Dak	Preparation and shipping, miscellaneous, and exemption work.	1909	E. H. Clark	$1,320
Faribault, Minn	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1913	T. W. Scott	1,800
Fergus Falls, Minn	do	1907	M. L. Davenport	1,920
Fitchburg, Mass	Preparation and shipping, miscellaneous.	1910		1,230
Fort Atkinson, Wis	Ante-mortem, post-mortem, preparation and shipping, miscellaneous.	1906		800
Fort Smith, Ark	Preparation and shipping, miscellaneous, and exemption work.	1909	W. B. Nichols	1,320
Fort Wayne, Ind	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	E. W. Barthold	4,900
Fort Worth, Tex	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, exemption work, and import meats.	1902	A. O. Lundell	57,132
Grand Rapids, Wis	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1909	F. O. Kickbusch	2,640
Granite City, Ill	Ante-mortem, post-mortem, and miscellaneous.	1914		300
Greenville, Tenn	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1907		400
Greenville, Tex	Preparation and shipping, miscellaneous.	1906		500
Greenville, Miss	do	1910		1,260
Greenwood, Ind	Preparation and shipping	1915		400
Gretna, La	Preparation and shipping, miscellaneous.	1906		1,212
Guttenberg, N. J	do	1906		1,200
Hallstead, Pa	Ante-mortem, post-mortem, miscellaneous, exemption work, and preparation and shipping.	1908	S. M. Page	1,800
Hamilton, Ohio	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1906		1,860
Harrisburg, Pa	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	W. C. Siegmund	6,529
Hartford, Conn	Preparation and shipping, miscellaneous, import meats, public markets, and exemption work.	1906	W. E. Jennings	1,326
Harvey, La	Preparation and shipping, miscellaneous.	1911		1,260
Haverhill, Mass	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, public markets, and exemption work.	1906	H. Q. Thompson	5,296
Highlandtown, Md	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1906		6,800
Hoboken, N. J	Preparation and shipping, miscellaneous.	1906		1,212
Houlton, Me	Ante-mortem, post-mortem, miscellaneous.	1914		900
Houston, Tex	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, and exemption work.	1906	C. F. Palmer	10,905
Hudson, N. Y	Preparation and shipping, miscellaneous.	1906		1,260
Indianapolis, Ind	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1892	G. W. Butler	62,839
Jacksonville, Ill	do	1906	J. B. Clancy	3,200
Jacksonville, Fla	Preparation and shipping, miscellaneous.	1909		1,350
Jefferson, Wis	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	Geo. Jerome	2,000
Jersey City, N. J	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, Navy inspection, public markets, and exemption work.	1891	R. M. Mullings	37,743
Kansas City, Kans	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, Navy inspection, exemption work, and laboratory meat inspection.	1891	J. Fleming	267,662
Kansas City, Mo	Preparation and shipping, miscellaneous.	1906		1,600
Kearney, N. J	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1904		10,800
Keene, N. H	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1908		1,225
La Crosse, Wis	do	1906	R. E. Christopher.	3,000
Lafayette, Ind	do	1906	C. H. Herrold	4,400
Langhorne, Pa	Preparation and shipping, miscellaneous.	1913		400
Lebanon, Pa	do	1906		1,260
Leesburg, Va	do	1911		150

MEAT-INSPECTION STATIONS—Continued.

Location.	Character of work.	Date begun.	Assignment.	Proposed expenditures, 1915–16.
Lewiston, Idaho	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1907	L. B. Dunlap	$2,819
Logansport, Ind	....do	1906	E. H. Carter	3,900
London, England	Miscellaneous duties relating to consignments of meats and meat food products exported from the United States to Great Britain, and other work.	1890		4,404
Los Angeles, Cal	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, Navy inspection, public markets, and exemption work.	1896	G. T. Irons	36,436
Louisville, Ky	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, public markets, and exemption work.	1896	S. L. Bond	9,934
Lynn, Mass	Preparation and shipping, miscellaneous.	1906		1,212
Madison, Ind	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	H. Loth	1,807
Manchester, N. H	Preparation and shipping, miscellaneous, public markets, and exemption work.	1907	J. Hurley	1,503
Marshalltown, Iowa	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1896	D. E. Collins	5,600
Mason City, Iowa	....do	1904	R. W. Culbert	6,683
Media, Pa	Ante-mortem, post-mortem, preparation and shipping, miscellaneous.	1907		600
Memphis, Tenn	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, and exemption work.	1906	J. O. F. Price	9,004
Menominee, Mich	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1911	S. S. Snyder	1,800
Middletown, N. Y	Preparation and shipping, exemption work.	1910		1,345
Milwaukee, Wis	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, public markets, and exemption work.	1891	A. E. Behnke	41,599
Mobile, Ala	Preparation and shipping, miscellaneous.	1908		1,380
Morristown, Tenn	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1907	W. T. Conway	1,342
Moscow, Idaho	....do	1911	E. D. Kennedy	1,800
Moultrie, Ga	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1914		3,000
Nashville, Tenn	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1904	W. B. Lincoln	9,382
Natchez, Miss	....do	1908	P. J. Huffman	7,908
National Stock Yards, Ill.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, exemption work, and laboratory meat inspection.	1892	E. L. Bertram	114,294
Nebraska City, Nebr	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1901	E. F. Haven	6,800
Newark, N. J	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, public markets, and exemption work.	1904	A. F. Martins	13,947
New Bedford, Mass	Preparation and shipping	1915		400
New Castle, Pa	Preparation and shipping, miscellaneous.	1911		1,040
New Haven, Conn	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, public markets, and exemption work.	1899	R. O. Brock	8,936
New Orleans, La	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, Navy inspection, public markets, and exemption work.	1906	R. W. Tuck	4,664
Newport, R. I	Preparation and shipping, miscellaneous.	1906		2,500
New York, N. Y	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, Navy inspection, public markets, exemption work, and laboratory meat inspection.	1891	N. L. Townsend	191,749
Norfolk, Va	Preparation and shipping, miscellaneous, import meats, Navy inspection, public markets, and exemption work.	1908	T. M. Owen	2,460

MEAT-INSPECTION STATIONS—Continued.

Location.	Character of work.	Date begun.	Assignment.	Proposed expenditures, 1915–16.
North Adams, Mass.	Preparation and shipping, miscellaneous.	1909		$1,230
North Augusta, S. C.	Ante-mortem and post-mortem.	1908		1,600
North Bergen, N. J.	Ante-mortem, post-mortem, miscellaneous, and preparation and shipping.	1906		1,800
Northfork, W. Va.	Preparation and shipping, miscellaneous.	1914		1,460
North Portland, Oreg.	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1910		10,800
North Tazewell, Va.	Ante-mortem, post-mortem, preparation and shipping, and exemption work.	1913	O. J. Huth	1,887
Ogden, Utah	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	R. B. Leeper	4,603
Oklahoma, Okla.	do	1906	J. S. Grove	41,860
Olathe, Kans.	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1906		1,860
Olean, N. Y.	Preparation and shipping, miscellaneous.	1908		1,240
Ottumwa, Iowa	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1892	P. J. Brady	24,078
Palmyra, Pa.	Preparation and shipping, miscellaneous.	1909		200
Passaic, N. J.	do	1906		2,400
Paterson, N. J.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, and exemption work.	1906	A. McBride	12,257
Pawtucket, R. I.	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1906		4,200
Pensacola, Fla.	Preparation and shipping, miscellaneous.	1912		1,320
Peoria, Ill.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	A. N. Hughes	8,980
Philadelphia, Pa.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, Navy inspection, public markets, and exemption work.	1893	C. A. Schaufler	81,422
Phillipsburg, N. J.	Preparation and shipping, miscellaneous.	1909		460
Pittsburg, Kans.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	J. E. Blackwell	2,000
Pittsburgh, Pa.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, and exemption work.	1892	G. E. Totten	29,114
Pomona, Cal.	Ante-mortem, post-mortem, preparation and shipment, and miscellaneous.	1908		1,800
Port Chester, N. Y.	Preparation and shipping	1913		1,220
Port Huron, Mich.	Preparation and shipping, miscellaneous.	1915		1,240
Portland, Me.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, public markets, and exemption work.	1896	F. W. Huntington	7,056
Portland, Oreg.	do	1897	E. C. Joss	16,938
Pottsville, Pa.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	G. H. Woolfolk	6,000
Providence, R. I.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, Navy inspection, public markets, and exemption work.	1906	H. M. Smith	14,078
Pueblo, Colo.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	T. S. Rich	4,040
Purcellville, Va.	Preparation and shipping, miscellaneous.	1912		200
Quincy, Ill.	Preparation and shipping, miscellaneous, public markets, and exemption work.	1908	L. H. Howlett	1,320
Reading, Pa.	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1914		3,040
Reno, Nev.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, public markets, and exemption work.	1906	J. H. Webster	4,617
Richmond, Ind.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	C. O. Wagoner	1,920
Richmond, Va.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, public markets, and exemption work.		H. Marshall	14,350
Rochester, N. Y.	Preparation and shipping, miscellaneous, import meats, and exemption work.	1906	P. W. Campbell	1,356
Rosedale, Kans.	Preparation and shipping, and miscellaneous.	1913		300

MEAT-INSPECTION STATIONS—Continued.

Location.	Character of work.	Date begun.	Assignment.	Proposed expenditures, 1915-16.
Rosslyn, Va.	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1906		$1,812
St. Louis, Mo.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, public markets, and exemption work.	1895	J. J. Brougham	66,384
St. Paul, Minn.	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1906		2,400
Salt Lake City, Utah	Preparation and shipping, miscellaneous. and exemption work.	1906	F. E. Murray	2,200
San Antonio, Tex.	Preparation and shipping, miscellaneous.	1911		1,260
San Diego, Cal.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, Navy inspection, and exemption work.	1901	W. M. MacKellar	6,186
San Francisco, Cal.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, Navy inspection, public markets, exemption work, and laboratory meat inspection.	1895	H. H. Hicks	28,665
Savannah, Ga.	Preparation and shipping, miscellaneous, and import meats.	1906		1,320
Seattle, Wash.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, Navy inspection, public markets, and exemption work.	1900	J. Madsen	26,451
Sherman, Tex.	Preparation and shipping, miscellaneous.	1906		1,320
Shreveport, La.	Preparation and shipping, miscellaneous, and exemption work.	1908	L. Bryant	1,320
Sioux City, Iowa	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and ex-exemption work.	1894	T. A. Shipley	74,289
Sioux Falls, S. Dak.	do	1906	C. Miller	14,827
Smithfield, Va.	Preparation and shipping, miscellaneous.	1908		1,200
Somerville, Mass.	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1891		28,900
SouthBellingham, Mass	Preparation and shipping, miscellaneous.	1907		600
South Omaha, Nebr.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, Navy inspection, public markets, exemption work, and laboratory meat inspection.	1891	H. Busman	179,925
South St. Joseph, Mo.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, public markets, exemption work, and import meats.	1898	M. O. Anderson	104,254
South St. Paul, Minn.	Ante-mortem, post-mortem, miscellaneous, preparation and shipping, import meats, and exemption work.	1895	F. D. Ketchum	42,372
Spokane, Wash.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1906	C. M. McFarland	18,852
Springfield, Mass.	Preparation and shipping, miscellaneous, public markets, and exemption work.	1906		2,400
Stamford, Conn.	Preparation and shipping, miscellaneous.	1913		1,320
Sugar Land, Tex.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous.	1914		1,660
Syracuse, N. Y.	Preparation and shipping, and miscellaneous.	1906		1,320
Tacoma, Wash.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, and exemption work.	1904	F. Loman	7,619
Terre Haute, Ind.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1912	C. B. Weagley	2,826
Texarkana, Tex.	Preparation and shipping and exemption work.	1913	H. G. Potter	1,351
Topeka, Kans.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1901	W. L. Johnson	8,040
Trenton, N. J.	Preparation and shipping and public markets.	1906		1,800
Vicksburg, Miss.	Preparation and shipping, miscellaneous.	1912		1,260
Walla Walla, Wash.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1907	H. E. Pinkerton	4,380
Washington, D. C.	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, Navy inspection, public markets, and exemption work.	1906	H. K. Walter	10,460

MEAT-INSPECTION STATIONS—Continued.

Location.	Character of work.	Date begun.	Assignment.	Proposed expenditures, 1915–16.
Waterloo, Iowa	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1900	F. T. Suit	$7,560
Watertown, S. Dak	do	1913	R. G. Rice	1,800
West Chester, Pa	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1912		900
West Newbury, Mass	do	1906		1,400
West Toledo, Ohio	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, and exemption work.	1906	S. W. Burt	7,030
Wheeling, W. Va	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, public markets, and exemption work.	1906	W. O. Trone	12,808
White Hall, Ill	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1914		800
Wichita, Kans	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1897	J. S. Kelly	39,405
Wilmington, Del	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, public markets, and exemption work.	1906	G. E. Repp	6,200
Wilmington, N. C	Preparation and shipping, miscellaneous.	1913		1,380
Winona, Minn	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, and exemption work.	1907	W. J. Fretz	6,200
Woodsdale, Ohio	Ante-mortem, post-mortem, preparation and shipping, and miscellaneous.	1908		25
Worcester, Mass	Ante-mortem, post-mortem, preparation and shipping, miscellaneous, import meats, public markets, and exemption work.	1898	M. T. Perry	8,194
Youngstown, Ohio	Preparation and shipping, public markets, and exemption work.	1908		1,800
Zion City, Ill	Ante-mortem, post-mortem. preparation and shipping, and miscellaneous	1913		1,225
Total, Meat-Inspection Stations				3,214,674

DAIRY INVESTIGATIONS.

ADMINISTRATION.

Administration:

Object.—General supervision of the Dairy Division work, including branch library, files, requisitions and accounts, dairy engineering, compilation and indexing, and editorial and stenographic work.

Location.—Washington D. C.

Date begun.—1895.

Assignment.—B. H. Rawl.

Proposed expenditures, 1915–16.—$25,055 (research, $12.755; extension, $10,400; regulation, $1.900).

DAIRY FARMING.

Supervision:

Object.—General supervision and office correspondence and record work; compilation of material for use in field work and preparation of manuscripts.

Location.—Washington, D. C.

Date begun.—1906.

Assignment.—Helmer Rabild.

Proposed expenditures, 1915–16.– $12.080 (research. $6.500; extension, $5.580).

[Extension.]

Community Development in Dairying:

Object.—To demonstrate the practicability of the small community raising its economic status through the employment of a field instructor skilled in dairying.

Procedure.—The creamery butter maker and manager are to be taught how to operate the creamery in the best manner possible. In addition to this, one man will work among the patrons of the creamery, making a survey of all the farms to determine how they are operated, how much the cows are producing, how the cream is hauled, etc. In the meantime the creamery will be grading each patron's cream for quality. When the survey is completed the patrons will be assembled and shown the conditions, which will probably be indicated on a chart. Those who are producing good cream will be shown that they are receiving from 1 to 3 cents per pound less for their cream because it is mixed with the poor cream from the other patrons. Those who are producing poor cream will be offered assistance in improving the quality of their cream. An effort will also be made to have the cream paid for by grade. The field man will give the patrons assistance in improving their herds, inducing the dairymen to keep records of each cow in their herds, to sell all unprofitable cows, and to use pure-bred bulls. He will give instruction in proper crop rotation, in the feeding of the herd, etc. He will assist in the building of silos and other dairy buildings and will give lectures at farmers' institutes and other public meetings.

Cooperation.—Iowa State College and the State dairy and food commission.

Location.—Algona, Iowa.

Date begun.—1910.

Results.—Monthly meetings are held at different farms. A boys' encampment was held in 1912, 1913, and 1914 on an up-to-date farm, where the boys learned improved methods at first hand. A new creamery has been built. Many silos and dairy buildings have been built. Sixteen pure-bred bulls have been purchased and production records kept on 150 cows. Cream is graded into two grades during the summer months, and 3 cents more per pound is paid for butter fat in sweet cream than for that in sour cream. Farmers have grown numerous leguminous crops and have kept their dairy buildings in better sanitary condition.

Probable date of completion.—1917.

Assignment.—R. R. Welch, F. L. Odell.

Proposed expenditures, 1915–16.—$2,040.

Southern Dairying:

Object.—To encourage the development of the dairy business by instruction and demonstration.

Procedure.—Farmers are instructed in the feeding of dairy cows, the raising of calves, and the construction of silos and dairy buildings. Herd records are introduced and advice given in the selection of pure-bred bulls. An endeavor will be made to improve the quality of dairy products. Work will be taken up with rural schools and creamery extension work done in cooperation with the dairy manufacturing section.

Cooperation.—Extension departments of the colleges of agriculture in the States named under "Location."

Location.—North Carolina, South Carolina, Georgia, Alabama, Tennessee, Mississippi, Louisiana, Arkansas, and Oklahoma.

Date begun.—1905.

Results.—About 900 homemade silos and a large number of dairy barns and dairy houses have been built and remodeled; 510 dairymen have begun keeping herd records; 140 pure-bred bulls added to herds; 15 live-stock and dairy associations formed; 80 short-course dairy schools conducted. Creameries have been established at colleges of North Carolina, South Carolina, and Alabama. Merchants have been induced to handle improved dairy supplies. The price of country butter has been raised, due to improved quality. Elementary dairy instruction has been given in rural schools, and the children of one school have shipped cream cooperatively. Model dairy plants have been established at four fair grounds. A number of bulletins and circulars have been issued by the

Southern Dairying—Continued.

field agents in the various States, and eight circulars were prepared by the Dairy Division with special reference to this work.

Assignment.—J. H. McClain.

Proposed expenditures, 1915–16.—$18,940.

Dairy Demonstration Farm:

Object.—To demonstrate the practicability of reclaiming a worn-out cotton farm by dairying.

Procedure.—A pure-bred bull will be used in the dairy herd, records kept of the production of each cow, and heifer calves from only the best cows retained in the herd. Home-grown roughage will be used so far as possible, crop rotations established, suitable buildings erected, and permanent pastures established.

Cooperation.—Denison Board of Trade.

Location.—Denison, Tex.

Date begun.—1907.

Results.—A demonstration herd has been established, starting with scrub cows and a pure-bred bull. The present herd is of uniform type and butter-fat production has been increased from 139 pounds to 241 pounds. The average production of heifers with three lactation periods is 5,208 pounds of milk and 252 pounds of butter fat, while their dams averaged 4,315 pounds of milk and 197.8 pounds of butter fat. The fertility of the farm has been greatly increased by the addition of the manure from the dairy herd and 1,000 loads of manure hauled from Denison. Excessive erosion of the soil has been practically stopped.

Probable date of completion.—1917.

Assignment.—S. B. Durham.

Proposed expenditures, 1915–16.—$1,620.

Cooperation with County Agents in Dairy Work:

Object.—To assist county agents with general dairy work, such as silo and dairy building construction, feeding, care, and management of dairy cattle, special assistance at fairs, etc.

Procedure.—Upon request. advice and assistance will be given county agents along different lines of dairy work. A dairy specialist will join the county agent for a week or two to help start dairy work. The county agent is usually not trained in dairying, but with a little assistance occasionally from one who is so trained he can carry on the work. The dairy specialist will assist him in the construction of silos, dairy barns, dairy houses, etc.

Cooperation.—County agents of the States Relations Service in Northern, Eastern, and Middle-Western States.

Location.—See "Cooperation."

Date begun.—1914.

Results.—The work has been taken up in a number of States. and project agreements for cooperative dairy extension work are being drawn up with each State in which the work is done.

Assignment.—Helmer Rabild.

Proposed expenditures, 1915–16.—$10,570.

Cow-Testing Associations and Bull Associations:

Object.—To increase economically the average milk and butter production of the dairy cows in the United States, and to improve the quality of dairy herds.

Procedure.—A campaign will be inaugurated to investigate the general profitableness of dairy herds, to eliminate the unprofitable cows, and build up the herds by the use of pure-bred bulls and by the selection of females. In territories where sufficient cows are found cooperative cow-testing associations will be organized. Bull associations are organized in territories where the herds are not sufficiently large to support a cow-testing association. The purpose of a bull association is the joint ownership of meritorious bulls. Where the State can be interested in this work, the supervision of the associations will be under the State agency which has funds for carrying on such work. Where no interest is manifested by State authorities, it is hoped to demonstrate the value of this work in such a way that the State will provide funds for carrying it on.

LIBRARY OF THE COLLEGE OF AGRICULTURE

Cow-Testing Associations and Bull Associations—Continued.

Cooperation.—State dairy officials and associations, especially in New England and the Eastern and Middle States.

Location.—Throughout the United States.

Date begun.—1908.

Results.—181 cow-testing associations have been organized and records kept of 75,000 cows. Where continuous records are kept, the average production of butter fat has been increased over 22 per cent, while the profit from the herds has increased over 90 per cent. A large number of pure-bred bulls of high-producing ancestry have been added to the herds. Feeds have been selected adapted to the needs of the cows without increasing the cost of the ration. This work introduces business systems of record keeping on the dairy farm and fosters cooperation. Many associations purchase feed, fertilizer, seed, etc., jointly. B. A. I. Circular 179 and publications from some States cooperating have been issued.

Assignment.—Helmer Rabild.

Proposed expenditures, 1915–16.—$11,600.

[Research.]

Investigations in Cow-Testing Associations and Bull Associations:

Object.—To determine the best form of cooperation for the development and increase in entire production of the dairy herds of the United States.

Procedure.—A study is made of the best methods in vogue in the most successful cow-testing and bull associations and an adaptation of this work applied to the various sections of the United States. Summaries of the production and other records of cow-testing associations are compiled and studied with a view to bringing out any features which can be put into successful operation. An endeavor will be made to have the various colleges give courses in training men for this work so that the record-keeping part may be enlarged and complete records kept of all farm operations. An endeavor will also be made to evolve a simple cost-accounting system for the dairy farm to be administered through cooperation with dairy-testing associations.

Location.—Throughout the United States.

Date begun.—1908.

Results.—Compilations have been made of the records of a large number of cow-testing associations, and these results have been arranged in chart form to be used in extension work along this line.

Assignment.—Helmer Rabild.

Proposed expenditures, 1915–16.—$6,000.

Holstein Cattle Breeding:

Object.—To breed Holstein cattle suitable for conditions in the semiarid West.

Procedure.—The organization of a cattle-breeding circuit similar to a combined cow-testing association and bull association. An agent employed jointly by the U. S. Department of Agriculture and the North Dakota Agricultural College will keep records of the breeding operations, feed consumed, and the milk and butter-fat production of the cows. An executive council will make regulations for the care of all animals and the sale of surplus stock. Experts will decide on the sale prices of animals sold.

Cooperation.—North Dakota Agricultural College.

Location.—New Salem, N. Dak.

Date begun.—1908.

Results.—An association of 16 members and 225 cows has been organized. The animals are all free from tuberculosis. Twelve cows have been placed in advanced registry and 12 pure-bred bulls purchased. The average milk production has been increased from 4,635 to 5,778 pounds, and the butter-fat production from 180 to 207 pounds. A number of pure-bred Holstein bulls and grade heifers and cows have been sold to other sections of the State, the demand far exceeding the supply. Bulletin 109 of the North Dakota Experiment Station gives in detail the results secured.

Probable date of completion.—1917.

Assignment.—U. J. Downey.

Proposed expenditures, 1915–16.—$1,000.

Total, Dairy Farming, $63,850 (extension, $53,350; research, $13,500).

DAIRY MANUFACTURING.

Supervision:

Object.—General supervision of all work in dairy manufacturing, including extension work done with creameries by correspondence; compilation of information collected

Location.—Washington, D. C.

Date begun.—1906.

Assignment.—S. C. Thompson, William White.

Proposed expenditures, 1915–16.—$7,530 (research, $2,500; extension, $4,030; regulation, $1,000).

[Research.]

Creamery Management Investigations:

Object.—To study methods for improving the quality of the milk and cream delivered to creameries and the quality of creamery butter, and to increase the general efficiency of creameries.

Procedure.—Through personal visits, correspondence, and personal supervision of certain creameries, data are gathered showing the conditions under which milk and cream are handled on the farm and at the creamery, the effect of a cream-grading system upon the quality of cream delivered, the fuel cost of creameries, the cost of the different operations in the manufacture of butter.

Location.—Washington, D. C., Grove City, Pa., Mora, Minn., and creameries throughout the United States.

Date begun.—1906.

Results.—Information has been gathered showing the conditions under which dairy products are handled from the production of the milk to the marketing of the butter. The effect of the use of a cream-grading system under certain conditions has been determined. Some data have been gathered showing the cost of fuel and of different operations in the manufacture of butter. Publications issued: B. A. I. Circular 126 and B. A. I. Bulletins 148 and 149.

Assignment.—S. C. Thompson, A. O. Dahlberg, O. A. Storvick, M. P. A. Sondergaard, W. B. Thurston.

Proposed expenditures, 1915–16.—$9,850.

Cheese Factory Investigations:

Object.—To determine in what districts it would be feasible to encourage the manufacture of cheese, what is being done in the manufacture of cheese in districts other than the cheese centers, and particularly what kinds of cheese can be successfully and profitably manufactured in certain sections of the South; to secure data relative to methods used in the best-managed factories; to determine what machinery is most efficient for cheese factories.

Procedure.—Data will be secured from reports by cheese factories in different sections of the country. Representatives will visit localities where cheese might be produced and endeavor to stimulate an interest in this industry. Studies will be made of equipment and methods of operating cheese factories.

Location.—United States.

Date begun.—1915.

Assignment.—C. F. Doane.

Proposed expenditures, 1915–16.—$500.

[Extension.]

Creamery Extension:

Object.—To improve the quality of milk and cream delivered to creameries, the quality of product, and the general efficiency of creameries.

Procedure.—Through personal visits, correspondence, circular letters, and a system of creamery reports advice is given in regard to establishing, building, equipping, operating, and managing creameries; to creamery patrons advice concerning the production and handling of milk and cream, the breeding, feeding, and managing of dairy cattle, the erection of silos and dairy buildings, and the keeping of herd records.

Cooperation.—Extension departments of the Vermont, Texas, South Dakota, and Iowa agricultural colleges.

Location.—United States.

Creamery Extension—Continued.

Date begun.—1908.

Results.—Many new creameries have been located and built in accordance with advice and plans from this division. Efficiency in creamery operation has been improved, as indicated by a material increase in the overrun obtained. Accounting systems have been improved. At certain creameries the quality of cream received has been greatly improved by the employment of a cream-grading system. This increased the financial returns to the creamery and to the patrons. Silos, dairy buildings, and ice houses have been erected under the supervision of field men, herds improved through purchase and breeding, herd records kept, production increased through better herd management, and the dairy industry in general benefited in those localities to which special attention has been given.

Assignment.—W. B. Liverance, C. W. Fryhofer, F. L. Odell, J. L. Thomas, Peter Van Allsburg.

Proposed expenditures, 1915–16.—$14,710.

Cheese Factory Extension:

Object.—To improve the quality of milk delivered to cheese factories; to improve the methods of making and hence the quality of cheese; to increase the general efficiency of cheese factories and their management.

Procedure.—Cheese factories will be asked to report monthly and annually to this office. Circular letters and correspondence will be sent to cheese factories relative to cheese-making problems. Representatives will visit factories to give instruction and will attend meetings of cheese-factory patrons.

Cooperation.—State of North Carolina; other cooperation to be arranged.

Location.—United States.

Date begun.—1914.

Results.—Preparatory work has been done in North Carolina.

Assignment.—C. F. Doane, E. L. Chaplin.

Proposed expenditures, 1915–16.—$2,830.

Farm Butter Making:

Object.—To improve the quality of the dairy butter produced in Tennessee, Alabama, North Carolina, South Carolina, and Georgia; and to promote dairy development in that territory.

Procedure.—A dairy manufacturing specialist calls on dairy farmers in the territory involved and gives them instructions in the art of butter making; he also acts as general adviser in dairy matters and attends meetings of farmers and dairymen.

Cooperation.—Extension departments of agricultural colleges in the States named under "Object."

Location.—Tennessee, Alabama, North Carolina, South Carolina, and Georgia.

Date begun.—1913.

Results.—A general survey of dairy conditions in the territory mentioned was made in order to learn what methods could best be used in the development of the dairy industry. It was found that the region is well adapted to dairying, but that there were not enough cows in the various communities to justify the establishment of creameries. It is therefore necessary to develop farm butter making. Many farmers have become interested in this work. Data on this work are published in Farmers' Bulletin 541, "Farm Butter Making."

Assignment.—G. A. Gilbert.

Proposed expenditures, 1915–16.—$2,850.

[Regulation.]

Renovated-Butter Inspection:

Object.—To carry on the inspection of renovated butter, the materials used in its manufacture, and factories producing this product, as required by the act of May 9, 1902.

Procedure.—At the plants where the inspection is done by Bureau of Animal Industry lay inspectors both the factory and the products are in-

Renovated-Butter Inspection—Continued.

spected frequently. Where no such inspectors are stationed, about three inspections are made each month. The chief inspector has general supervision of the inspection. The work is done according to regulations issued jointly by the Secretary of the Treasury and the Secretary of Agriculture under dates of July 11, 1907, September 30, 1908, October 23, 1911 (B. A. I. Order 147 and amendments 1 and 2 thereto, and supplement to amendment 1, and B. A. I. Order 193).

Location.—United States.

Date begun.—1902.

Results.—Factories are inspected at intervals by two regular renovated-butter inspectors and about 20 bureau lay inspectors. A sanitary condition of the factories and product is maintained. Compliance with the regulation regarding the marking of renovated-butter packages is required.

Assignment.—T. Corneliuson, M. W. Lang.

Proposed expenditures, 1915–16.—$7,500.

Butter Inspection for Navy Department:

Object.—To assist the Navy Department in securing first-class tinned and tub creamery butter and to study the manufacture of butter for storage.

Procedure.—Inspectors are stationed at the plants where butter for storage is packed for the Navy. These inspectors daily ascertain that both the raw material and the finished product comply with the requirements of the specifications. One man has general supervision of this work at all the plants.

Cooperation.—The Navy Department bears the expenses of the special inspectors, and furnishes samples of butter for examination and analysis.

Location.—At creameries throughout the United States securing contracts for Navy butter.

Date begun.—1902.

Results.—A marked improvement in the quality of the butter obtained as compared with the quality of butter of former years. Sweet cream is churned and the deterioration in quality is small.

Assignment.—T. Corneliuson.

Proposed expenditure, 1915–16.—$1,100.

Total, Dairy Manufacturing, $46,870 (research, $12,850; regulation, $9,600; extension, $24,420).

[Research.]

DAIRY RESEARCH LABORATORIES.

Supervision:

Object.—General supervision and office work of laboratories.

Location.—Washington, D. C.

Date begun.—1902.

Assignment.—L. A. Rogers.

Proposed expenditures, 1915–16.—$4,800.

Investigations of the Manufacture and Handling of Commercial Ice Cream:

Object.—To determine methods and conditions necessary for the practical, economical, and sanitary manufacture of ice cream.

Procedure.—The bacteriology of the raw materials entering into the product and the influence of these bacteria on the flavor and their value as an indication of insanitary conditions are studied. Studies are also made of the use of pure cultures in developing desirable flavors and of the influence of various constituents on the flavor and physical characters of the product, ice cream being manufactured on a laboratory scale to facilitate the investigation. The application of principles so established to practice will be determined by work on a commercial scale.

Cooperation.—Private individuals who manufacture ice cream.

Location.—Washington, D. C.

Date begun.—1912.

Results.—The numbers and kinds of bacteria which may be expected in commercial ice cream have been determined; influence on the flavor of a number of the usual constituents of ice cream determined; one paper ready for publication.

Assignment.—O. E. Williams, S. H. Ayers, C. J. Valaer.

Proposed expenditures, 1915–16.—$3,020.

Changes in Butter:

Object.—To determine the factors which control the flavor, both desirable and undesirable, of butter. This includes methods of handling cream, pasteurization, ripening of cream, changes of butter in storage, and methods of renovating.

Procedure.—A study of (1) the bacterial flora of cream under different conditions, the bacteria and yeasts of butter under normal conditions and as affected by different factors, such as the temperature and time of storage and the addition of antiseptics, and the relation of microorganisms to change in flavor; (2) the chemical changes in butter, the factors which control them, and the relation of these changes to the changes in flavor of the butter; (3) the effect of various creamery practices on the flavor of the butter and on the nature of the changes in storage.

Location.—Washington, D. C., and Grove City, Pa.

Date begun.—1902.

Results.—Bacteria are not a factor in the ordinary deterioration of butter. Factors increasing the rate of change are high acidity of cream, presence of metal salts, increased acid in butter, and high storage temperature. The principal cause of change in flavor is an oxidation of the nitrogenous constituents, in which nearly all the oxygen of the air inclosed in the butter is consumed. By eliminating many of these factors it is possible to make butter of exceptional keeping quality. Publications issued: B. A. I. Bulletins 57, 84, 89, 114, 148, 149, and 162, and B. A. I. Circulars 100, 130, 146, 189, and 200.

Assignment.—D. F. Dyer, A. O. Dahlberg, B. J. Davis.

Proposed expenditures, 1915–16.—$6,585.

Milk-Condensing Investigations:

Object.—To secure a general knowledge of milk condensing; to determine causes of spoilage and develop logical methods of operation.

Procedure.—Chemical and bacteriological studies on normal and abnormal milk and condensing experiments on a small scale. All new methods will be tested on a commercial scale in the experimental creamery.

Location.—Washington, D. C., and Grove City, Pa.

Date begun.—1914.

Results.—A survey of the methods of condensing in this country has been made and equipment planned for condensing on a laboratory and a commercial scale. No publications.

Assignment.—G. A. Menge.

Proposed expenditures, 1915–16.—$3,160.

Bacteriology of Milk:

Object.—To acquire complete and detailed knowledge of the bacteria occurring in milk, their relation to each other and to similar groups occurring elsewhere, their physiology and action on the constituents of milk, their habitat and the means by which they get into milk, and methods of preventing contamination and means of destroying bacteria in milk.

Procedure.—Biological studies will be made of particular groups, as, for instance, the morphology temperature limitations, food requirements, and natural habitat of the group of bacteria giving an alkaline reaction in milk. Similar studies will be made on the lactic-acid bacteria, the colon group, the bacteria inhabiting the udder of the cow, and other types of bacteria. The groups of bacteria established by these studies will be compared with similar bacteria found under natural conditions, and the means by which they are transmitted from their natural habitat to milk will be traced. Facilities for this work will be available at the Beltsville farm. Methods of destroying bacteria in milk will be determined by laboratory studies of pasteurization, action of ultra-violet rays, etc. This includes a study of the bacteria surviving pasteurization, the limits of heat which may be used as determined by changes in the milk, and the most efficient methods of pasteurization. It will be necessary at times to work on a commercial scale in city milk plants.

Location.—Washington, D. C., and Beltsville, Md.

Date begun.—1905.

Results.—Much exact information has been obtained on the biology of various groups of bacteria, particularly the colon group, the streptococci and the alkali-forming group, their relative numbers in milk, and their origin. The bacteriological and chemical changes which occur when milk

Bacteriology of Milk—Continued.

is pasteurized have been determined and a new and efficient method of pasteurization established. Publications issued: B. A. I. Bulletins 73, 126, 154, and 161, B. A. I. Circular 184, and nine other papers.

Assignment.—S. H. Ayers, Philip Rupp, W. T. Johnson, L. A. Rogers, W. M. Clark.

Proposed expenditures, 1915–16.—$8,300.

Physiology of Milk Secretion:

Object.—To obtain definite knowledge of the mechanism of milk secretion and of the factors which control or influence this function, with a view to a more logical breeding and feeding of dairy cows.

Procedure.—A preliminary study will be made of the histological changes occurring in the mammary gland before and during the lactation period. The subsequent procedure will depend on the results of this investigation.

Location.—Beltsville, Md.

Date begun.—1915.

Results.—Results of previous work on a similar project are published in B. A. I. Bulletins 111, 134, 155, 156, and 157, and papers on carotin and lactochrome.

Probable date of completion.—1918.

Assignment.—A physiologist and an assistant to be appointed.

Proposed expenditures, 1915–16.—$5,380.

Utilization of Creamery and Cheese-Factory By-Products:

Object.—To study methods for the utilization of by-products of creameries and cheese factories by converting them into products which will be useful in the arts or available as food for man or animals.

Procedure.—Chemical studies will be made of by-products and of the products into which they may possibly be converted. This will include investigations of new products and methods for their manufacture. At the experimental creamery skimmed milk will be condensed by various methods for ice-cream makers, bakers, and confectioners or converted into casein, milk sugar, albumin, etc. Attempts will be made to convert whey from cheese or casein manufacture into milk sugar or a flour for cooking purposes. When the practicability of a method has been established it will be applied on a commercial scale in order to determine the cost of production and the profits of manufacture.

Cooperation.—Bureau of Standards.

Location.—Washington, D. C., and Grove City, Pa.

Date begun.—1912.

Results.—An investigation into the manufacture of casein has shown that the qualities of buttermilk casein which make it inferior to skimmed-milk casein for paper making are its higher ash and fat content. A method of manufacture has been devised by which these faults can be corrected and a casein obtained which is apparently equal to skimmed-milk casein.

Assignment.—A. O. Dahlberg, B. J. Davis.

Proposed expenditures, 1915–16.—$600.

Disposal of Dairy, Creamery, and Cheese-Factory Wastes:

Object.—To provide means for the proper disposal of the wastes of dairy farms, creameries, and cheese factories.

Procedure.—Experimental sewage-disposal plants will be installed on the dairy farm at Beltsville, Md., and at the experimental creamery at Grove City, Pa. The condition of the effluent and the cost of operation of these plants will be observed, and modifications made as required. On the basis of the results obtained with these plants designs will be made for sewage-disposal plants for dairy farms, creameries, and cheese factories.

Cooperation.—Hygienic Laboratory, Public Health Service, and Office of Public Roads and Rural Engineering.

Location.—Grove City, Pa., and Beltsville, Md.

Date begun.—1915.

Results.—Plans have been made for experimental sewage-disposal plants for the dairy farm at Beltsville and for a creamery at Grove City.

Probable date of completion.—1918.

Assignment.—L. A. Rogers.

Proposed expenditures, 1915–16.—$500.

Manufacture and Ripening of Swiss Cheese:

Object.—To acquire complete and detailed knowledge of the factors producing the peculiar chemical and physical changes which give Swiss cheese its desirable character, and to apply this knowledge to practice.

Procedure.—Studies of the bacteria of normal and abnormal Swiss cheese and the relation of these bacteria to flavor and eye formation will be made. Chemical studies will be made of the changes which take place in ripening cheese and the relation of these changes to flavor and physical condition. Studies will be made of the methods of manufacture, conditions of ripening, and other factors which control the proper fermentation.

Cooperation.—Cheese factories.

Location.—Washington, D. C.

Date begun.—1907.

Results.—Chemistry and physics of eye formation worked out; bacteriological factors controlling the initial fermentation determined and method developed for applying this in practice, so that it is possible to eliminate much of the objectionable gassy fermentation; sufficient progress made in the control of the ripening process to extend Swiss cheese production to any season or any section in which good milk can be obtained. Publications: B. A. I. Bulletin 151 and Department Bulletin 148.

Probable date of completion.—1918.

Assignment.—C. F. Doane, W. M. Clark, H. A. Lubs.

Proposed expenditures, 1915–16.—$8,500.

Soft-Cheese Investigations:

Object.—To study the making and ripening of certain European varieties of soft cheese. This involves (*a*) a detailed study of the microorganisms active in their production; (*b*) the chemical determination of standards of composition with the complex changes involved in the ripening processes as applied to American milk and to the different climatic conditions encountered.

Procedure.—This work involves the culture of bacteria and molds met in the making and ripening of the different varieties, their identification and comparison with related species, and the determination of their relation to the changes found. Chemical analyses of the cheese will be made at every stage of production; also enzymic studies of the separate changes found to occur, with the analysis of the products of such change. Experimental manufacture will be carried on, beginning with the use of the foreign procedures of making and handling, and involving such alterations in the process as results from time to time may indicate.

Location.—Washington, D. C.

Date begun.—1906.

Results.—The factors essential to the manufacture and normal ripening of Camembert cheese have been established. A method has been developed for making a cheese of the Roquefort type from cow's milk. Publications: B. A. I. Bulletins 71, 82, 98, 109, 115, 118, and 120; Circular 145; Storrs (Conn.) Experiment Station Bulletins 78 and 79.

Assignment.—J. N. Currie, Alice C. Evans, K. J. Matheson.

Proposed expenditures, 1915–16.—$6,670.

Cheddar-Cheese Investigations:

Object.—To study methods of securing a more uniform product, the extent of losses and means of prevention, and bacteriological and chemical factors involved in the development of desirable and undesirable flavors.

Procedure.—Chemical and bacteriological studies and manufacturing experiments on a small scale will be carried on in laboratories at Washington. For example, the use of starters in suppressing undesirable fermentations and the influence of different types of bacteria on the characteristic flavor will be investigated. More extensive experiments in cheese making will be conducted in factories under temporary contracts.

Cooperation.—Cheese factories.

Location.—Washington, D. C.

Date begun.—1905.

Results.—Experiments on the storage of cheese have been carried on in cooperation with the Wisconsin and New York (Geneva) agricultural

Cheddar-Cheese Investigations—Continued.

experiment stations. From 1905 to 1909 manufacturing and storage investigations were carried on at factories in Wisconsin. From 1906 to 1914 cooperative work was carried on at the Wisconsin station on chemical and bacteriological changes in the ripening of Cheddar cheese and on methods of manufacture from pasteurized milk. This cooperative work was discontinued in 1914, and since that time the Cheddar-cheese work has been limited to an investigation of the practicability of ripening cheese in an hermetically sealed can. Publications: B. A. I. Bulletins 62, 85, 122, 123, 150, and 165; Circulars 166, 181, and 210; Journal of Agricultural Research, vol. 2, No. 3.

Assignment.—C. F. Doane.

Proposed expenditures, 1915–16.—$300.

Silage Investigations:

Object.—To study the changes which take place in the material put into the silo.

Procedure.—Chemical studies of silage made and preserved under known conditions will be conducted to determine the changes taking place in the silo at various stages of maturity.

Location.—Washington, D. C.

Date begun.—1912.

Results.—No difference was observed in the chemical composition or appearance of the silage from wooden and concrete silos. The loss in total weight and in food constituents has been determined in silage from the two kinds of silos.

Assignment.—R. H. Shaw, E. F. Deysher, P. A. Wright.

Proposed expenditures, 1915–16.—$2,460.

Chemical Investigations in the Feeding of Dairy Cattle:

Object.—To do the chemical work in connection with the feeding experiments conducted at Beltsville, Md.

Procedure.—Analyses are made of the feeding stuffs to determine their composition, digestibility, etc.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Analyses have been made of the feeds used in the feeding experiments, and the digestibility of these feeds has been determined.

Assignment.—R. H. Shaw, E. F. Deysher, P. A. Wright.

Proposed expenditures, 1915–16.—$2,510.

Total, Dairy Research Laboratories, $52,785.

MILK INVESTIGATIONS AND DEMONSTRATIONS.

Supervision:

Object.—To supervise the work of the section, answer correspondence, etc.

Location.—Washington, D. C.

Date begun.—1900.

Assignment.—Ernest Kelly.

Proposed expenditures, 1915–16.—$2,900 (research, $1,200; extension, $1,700).

[Research.]

Dairy Sanitation Investigations:

Object.—To study the sanitation of city milk supplies, investigate factors influencing the commercial quality of milk, and devise means for producing and handling milk of a superior quality.

Procedure.—Studies are made of farms supplying milk to cities throughout the country, and of plants handling milk in the cities, with a view to discovering efficient methods and equipment. A large number of milk and cream samples are studied to note the effect of various operations on the bacterial content of milk and the effect of certain feeds on the flavor of milk.

Cooperation.—State and municipal boards of health and dairymen.

Location.—United States.

Date begun.—1900.

Dairy Sanitation Investigations—Continued.

Results.—Data on the extra cost of producing clean milk, the milk supplies of Chicago and Washington, the control of bulk milk in stores, and the work of medical milk commissions published in B. A. I. Circulars 170 and 270, Bulletin 138, and Department Bulletin 1.

Assignment.—Ernest Kelly, L. B. Cook, J. A. Gamble, R. S. Smith.

Proposed expenditures, 1915–16.—$2,960.

Cost of Handling Milk:

Object.—To determine the cost of handling milk in cities, including the cost of various operations in preparing milk for the market; to discover uneconomical methods and suggest ways of lessening the cost of handling.

Procedure.—Surveys are made of milk plants in various cities to obtain the desired information. A cooperative agreement exists between this bureau and the Office of Markets and Rural Organization regarding this work.

Cooperation.—Office of Markets and Rural Organization; milk dealers.

Location.—United States.

Date begun.—1912.

Results.—Surveys have been made of nearly 100 milk plants. A large mass of data has been gathered dealing with investment, labor, organization, and various other items. The results of these investigations have been brought to the attention of milk dealers by means of monthly circular letters.

Assignment.—C. E. Clement.

Proposed expenditures, 1915–16.—$2,690.

Cost of Milk Production:

Object.—To ascertain the actual cost of milk production on the average dairy farm; to learn the increased cost of milk production attributable to modern sanitary methods and variation in cost of milk production in different sections.

Procedure.—Field agents will be employed in three or four States, who will make observations on a group of dairy farms to ascertain the various costs connected with milk production.

Cooperation.—North Carolina Experiment Station; extension department of the Indiana College of Agriculture.

Location.—North Carolina and Indiana; possibly one other State.

Date begun.—1914.

Probable date of completion.—1918.

Assignment.—J. B. Bain.

Proposed expenditures, 1915–16.—$6,700.

[Extension.]

Dairy Sanitation Extension:

Object.—To carry on educational work among dairymen and milk handlers and to unify and make more efficient inspections carried on by State and municipal boards of health.

Procedure.—This work is done almost exclusively in cooperation with the State and municipal boards of health. Visits are made to cities at the request of the proper authorities, and inspectors are instructed in an efficient system of dairy and milk inspection.

Cooperation.—State and municipal boards of health and State dairy commissioners.

Location.—United States.

Date begun.—1900.

Results.—Many city milk supplies have been greatly improved from a sanitary standpoint. A large number of health departments have inaugurated an efficient and systematic control of milk supplies. Publications: B. A. I. Circulars 199 and 205; Farmers' Bulletin 602.

Assignment.—Ernest Kelly, L. B. Cook, J. A. Gamble, R. S. Smith.

Proposed expenditures, 1915–16.—$8,300.

Total, Milk Investigations, $23,550 (research, $13,550; extension, $10,000).

[Research.]

DAIRY DIVISION EXPERIMENT FARM.

Supervision:

Object.—Supervision of all work in dairying at the dairy experiment station.

Procedure.—A farm superintendent supervises all the work of the farm, including experimental investigations.

Location.—Beltsville, Md.

Date begun.—1910.

Assignment.—T. E. Woodward.

Proposed expenditures, 1915–16.—$5,620.

Breeding of Dairy Cattle:

Object.—To study the breeding of dairy cattle and to apply such principles of breeding as are established.

Procedure.—The dairy herd that is being developed at the Beltsville station will be used for this purpose. Part of this study will be made with purebred cattle and part with grade cattle. The grade cattle will be used for determining the practicability of inbreeding for one generation. Two breeds will be used at the Beltsville station for this work. Later it is proposed to arrange with a number of farmers to carry on similar breeding under the supervision of the leader of this work. The study of purebred cattle will relate to the various systems of breeding upon productivity, vigor, prepotency, etc.

Location.—Beltsville, Md.

Date begun.—1912.

Results.—Thus far the only work done has been with grade cattle. Twenty-two grade cows are now being bred according to this plan.

Assignment.—T. E. Woodward.

Proposed expenditures, 1915–16.—$4,000.

Feeding Dairy Cattle:

Object.—To ascertain the effects of the various feeds and constituents of feeds upon the animal body, upon growth, and upon the yield and composition of milk; to find out the relative values of feeds for dairy production.

Procedure.—All the dairy animals on the Beltsville farm will be used for experimental work. Feeds and constituents of feeds of known composition will be fed selected animals in definite amounts and for stated periods. The results are measured in one or more of several ways, depending on the nature of the particular experiment, such as palatability and digestibility of the food, health, vigor, and growth of the animals, production of milk and fat, and the composition and flavor of dairy products. Chemical analyses of the feed and the product, and in some cases of the excreta also, are required.

Location.—Beltsville, Md.

Date begun.—1913.

Results.—The feeding value of sour skimmed milk for young calves has been determined; also the influence of water in the ration upon the composition of milk. In cooperation with the milk section of this division it was found that beet pulp injured the flavor of milk. It was especially noticeable when milk was allowed to stand for several days. The value of cactus and prickly pear as feed for dairy cows has been determined and the results have been prepared for publication. Experiment at the Naval Academy to determine the feeding value of cornstalk extract completed.

Assignment.—W. F. Turner.

Proposed expenditures, 1915–16.—$4,640.

Housing and Care of Dairy Cattle:

Object.—To determine the best method of stabling cows; to investigate problems in the milking and care of cows and herd management.

Procedure.—The cattle will be housed and cared for under different conditions and the results measured in one or more of several ways, such as health and vigor of the herd, growth, production, economy of feeding, operation and construction, and sanitation of the milk.

Location.—Beltsville, Md.

Housing and Care of Dairy Cattle—Continued.

Date begun.—1912.

Results.—It has been demonstrated that the open shed is successful. It keeps the cows clean and healthful and provides for the saving and storage of manure in the best known way. The comparison of floor materials has not progressed far enough to make possible the drawing of any conclusions. The effect of the southern cattle tick on milk production and body weight of dairy cows has been determined.

Assignment.—W. F. Turner.

Proposed expenditures, 1915–16.—$3,920.

Feed Production:

Object.—Primarily, to produce feed for the dairy herd. Detailed records are kept of the cost of all farm operations and observations made on the building up of the soil by fertilization, tillage, and drainage.

Procedure.—About 170 acres of the Dairy Division Experiment Farm are tillable, and all of this area is devoted to the growing of crops for the dairy cattle and for the maintenance of work stock. Detailed records are kept of the cost of all operations.

Cooperation.—Bureau of Soils and Office of Public Roads and Rural Engineering.

Location.—Beltsville, Md.

Date begun.—1910.

Results.—Land has been cleared, ditches silled, 36,000 feet of drain tile laid, the roads through the farm and around the buildings graded and surfaced, and grading done around the buildings. The land has been improved by the application of manure and lime, and feed has been grown for the dairy herd. The farm has been equipped with machinery.

Assignment.—W. R. Hale.

Proposed expenditures, 1915–16.—$7,690.

Silage Investigations:

Object.—To determine the advantages and disadvantages of the various materials used in building and preserving silos, find the stage of maturity at which the corn plant should be siloed, and try siloing various farm crops.

Procedure.—A comparison will be made of different materials used in silo construction. Changes taking place in the silo with crops at various stages of maturity will be noted, in order to learn the best time of harvesting.

Cooperation.—Office of Public Roads and Rural Engineering.

Location.—Beltsville, Md.

Date begun.—1912.

Results.—The temperature in the stave silo ran uniformly several degrees higher than those in the concrete silo. Much less silage per acre was obtained from sweet sorghum than from corn. Data in Farmers' Bulletin 578.

Assignment.—W. R. Hale.

Proposed expenditures, 1915–16.—$1,190.

Metabolism in Dairy Cows:

Object.—To determine the total energy of the feed consumed by milking animals, the losses of energy in the excreta, the expenditure of energy consequent upon the consumption of the feed and, by difference, the net energy of the feed; to determine the distribtuion of this net energy of the feed between the two possible forms of production, viz, fattening or milk secretion, and the effect upon it of the quantity and quality of the feed, as well as of other factors.

Procedure.—(1) Determine the maintenance requirement of the dry animal. (2) Feed a moderate ration and by means of successive respiration calorimeter experiments trace the variations in the distribution of net energy between milk production and body gain with advancing lactation. In this way it is hoped to determine the quantitative relation between the two forms of production. (3) Study the effect of varying amounts of the same combination of feeding stuffs in increasing the milk production on the one hand and the body gain of the animal on the other hand. (4) Study the effect upon milk production and body gain of substituting protein for carbohydrates, or vice versa, in rations otherwise identical.

Metabolism in Dairy Cows—Continued.

Cooperation.—Animal Nutrition Institute of Pennsylvania State College.

Location.—Beltsville, Md., and State College, Pa.

Date begun.—July 1, 1915.

Assignment.—H. P. Armsby, State College, Pa.; T. E. Woodward, Beltsville.

Proposed expenditures, 1915–16.—$4,000.

Construction of Buildings:

Object.—To construct such buildings as are required for conducting breeding, feeding, and other dairy-farming investigations.

Location.—Beltsville, Md.

Date begun.—1911.

Results.—A concrete cow barn, a small milk house, three silos, and a herdsman's cottage have been built; water, light, and a sewer system installed; a building for offices and laboratories completed. The east wing of the cow barn has been remodeled; a cow shed and a 30,000-gallon water reservoir built.

Assignment.—K. E. Parks, O. D. Howell.

Proposed expenditures, 1915–16.—$6,220.

Total, Dairy Division Experiment Farm, $87,280.

[Extension.]

WESTERN DAIRY EXTENSION.

Supervision:

Object.—General supervision of western dairy extension work, including clerical work, general correspondence, etc.

Location.—Salt Lake City, Utah.

Date begun.—1911.

Assignment.—J. E. Dorman.

Proposed expenditures, 1915–16.—$4,480.

Dairy Farming:

Object.—To improve and develop the business of dairying in the Western States.

Procedure.—Cooperative field agents will be appointed to instruct farmers in feeding dairy cows, raising calves, and construction of silos and dairy buildings. Herd-record work will be introduced and advice given in the selection of pure-bred bulls. An endeavor will be made to improve the quality of dairy products, work will be taken up with rural schools, and aid given to county agents in handling their dairy problems.

Cooperation.—Extension departments of the agricultural colleges in the States named under "Location."

Location.—Washington, Oregon, Idaho, Montana, Wyoming, Nevada, Utah, and New Mexico.

Date begun.—1908.

Results.—One section of Idaho has purchased 4,000 dairy cows; a large number of silos and dairy buildings erected; 10 cow-testing and two bull associations formed; and a large number of dairymen are keeping records of the production of their cows. Fourteen schools have conducted dairy-herd record contests. Several publications have been prepared by the dairy field agents and issued by the colleges cooperating.

Assignment.—J. E. Dorman.

Proposed expenditures, 1915–16.—$21,890.

Milk Work:

Object.—To carry on educational work among dairymen and milk handlers, and to unify and make more efficient inspections carried on by State and municipal boards of health.

Procedure.—This work is done almost exclusively in cooperation with the State and municipal boards of health. Visits are made to cities at the request of the proper authorities and inspectors are instructed in an efficient system of dairy and milk inspection.

Cooperation.—State and city boards of health.

Location.—Western United States.

Date begun.—1912.

Milk Work—Continued.

Results.—Milk and cream contests have served to point out defective methods of production; complete economic surveys made of several milk plants; the dairy-farm score card and the city milk-plant score card systems adopted by a number of city boards of health; plans for city milk plants and dairy buildings furnished to a number of dairymen.

Assignment.—F. H. Bothell.

Proposed expenditures, 1915–16.—$2,800.

Dairy Manufacturing:

Object.—To do educational work to introduce better methods and secure a uniformly good product.

Procedure.—Assistance is given to creameries and cheese factories where needed. Assistance is also given in the organization of creameries and cheese factories in localities having a sufficient number of cows. Butter-scoring contests are conducted and assistance is given by correspondence.

Cooperation.—Creameries and cheese factories in Washington, Oregon, Idaho, Montana, Wyoming, Nevada, Utah, and New Mexico.

Location.—Western United States.

Date begun.—1912.

Results.—Creamery conditions were found to be bad, poor records kept, and quality of butter very variable. Assistance by correspondence and personal visits has resulted in a marked improvement. A system of creamery records has been introduced, monthly butter-scoring contests established, and assistance given in properly equipping creameries and obtaining a good product. A pamphlet has been issued on "Creamery Accounts."

Assignment.—G. E. Frevert.

Proposed expenditures, 1915–16.—$2,620.

Total, Western Dairy Extension, $31,790.

Total, Dairy Investigations, $281,180 (research, $142,720; extension, $126,960; regulation, $11,500).

ANIMAL HUSBANDRY INVESTIGATIONS.

ADMINISTRATION.

Administration:

Object.—To provide for the general administration of the work in the Animal Husbandry Division. Such office expenses as are not directly chargeable to specific projects come under this head.

Location.—Washington, D. C.

Date begun.—1901.

Assignment.—George M. Rommel.

Proposed expenditures, 1915–16.—$18,160 (research, $10,000; extension, $7,500; regulatory, $660).

[Research.]

ANIMAL-BREEDING INVESTIGATIONS.

Close Breeding of Animals:

Object.—To study the principles of animal breeding by the use of small animals, most attention to date being paid to inbreeding.

Procedure.—Guinea pigs have been inbred, full brother and sister, for as many as 15 generations. It is proposed to continue this work, to broaden it, and make fundamental investigations of problems having a practical bearing on animal breeding.

Location.—Beltsville, Md.

Date begun.—1906.

Results.—A few monstrosities and a measurable decrease in birth weights, size, and vitality have been noticed, but fecundity has apparently increased.

Assignment.—F. R. Marshall.

Proposed expenditures, 1915–16.—$6,560.

LIVE-STOCK INVESTIGATIONS AND DEMONSTRATIONS.

[Research.]

Production of Pork:

Object.—To study the effect of feed on the growth and quality of hogs and the keeping quality of pork, the effect of feed on the physiological condition of hogs, the toxic effect of cottonseed-meal feeding, and the methods of farm curing of pork.

Procedure.—High-grade Berkshire pigs bred, raised, and fattened at the Beltsville farm will be used. The conventional methods of conducting feeding experiments will be followed to slaughtering time. The pigs will be slaughtered on the farm and the weight of offal taken. The feed will be analyzed by using representative samples and the digestibility determined if data already available are not sufficiently accurate. The weight of the vital organs will be taken and the bones tested for strength. Experiments will be conducted to determine whether the toxicity of cottonseed meal can be lessened. The meat will be cured, smoked, and subjected to the necessary chemical analysis.

Location.—Beltsville, Md.

Date begun.—1905.

Results.—Feed rations have been studied and improvements made on certain standard ones. Three experiments have been conducted to determine the effects of feeding various iron salts to prevent cottonseed-meal poisoning.

Probable date of completion.—1920.

Assignment.—George M. Rommel, James D. Bebout, Frank G. Ashbrook.

Proposed expenditures, 1915–16.—$6,640.

Live-Stock Production in the Appalachian Region:

Object.—To determine methods and cost of raising cattle, sheep, and swine economically in the Appalachian region, including the raising, fattening, and wintering of beef cattle.

Procedure.—A survey of the State of West Virginia has been made to determine the status of the live-stock industry, especially in those counties which are directly interested in beef cattle, sheep, and hogs. Leading stock farms were visited and records made of the breeds and number of animals kept, whether pure-bred or grades were used, methods of maintaining the herds and flocks, and various other facts that bear relation to a study of the situation. Beef-cattle work will first be undertaken. A suitable farm or farms will be selected for carrying on the cooperative experiments outlined under "Object."

Cooperation.—West Virginia Experiment Station.

Location.—Lewisburg, W. Va.

Date begun.—1914.

Results.—A live-stock survey was made of the principal stock-raising counties in West Virginia during the year 1914 to determine the present status of the beef-cattle industry in the different counties and to learn the weak points of the present system of conducting the live-stock work. During the winter of 1914–15 an experiment was conducted at Lewisburg, W. Va., to compare different methods of wintering yearling cattle. Yearlings wintered on hay and wheat straw, which is the customary manner of wintering yearlings, lost 46 pounds each in weight and were wintered at a cost of $9.21 each, while similar cattle which were fed on silage, cottonseed meal, and wheat straw gained 74 pounds each and cost but $8.34 per head to winter.

Probable date of completion.—1920.

Assignment.—W. F. Ward, E. H. Tuckwiller.

Proposed expenditures, 1915–16.—$1,500.

Beef Production in the South:

Object.—To determine methods and cost of raising beef cattle economically in Mississippi; to study methods of wintering various classes of beef cattle most economically under local conditions, and to study methods of finishing different classes of beef cattle in Mississippi for market.

Procedure.—Experiments will be conducted on two farms, one in the brown-loam and one in the black-prairie section of the State, under conditions

Beef Production in the South—Continued.

which exist on the average stock farm in Mississippi. A herd of breeding cattle will be maintained on each farm, which may be divided into similar lots for testing various farm feeds for wintering breeding stock economically. These herds will also be used in the breeding experiments for determining the cost of raising beef calves to various ages and the feeds which may be used in producing these animals most economically. These herds will also be used in the breeding experiments for determining the cost of raising beef calves to various ages and the feeds which may be used in producing these animals most economically. Other animals may be used for the experiments of finishing cattle for the markets. Some of these may be finished during the summer months, while others may be fed during the winter. Records will be kept showing the amounts of feed consumed by each lot, the weights and gains, the cost of production, and of all other data which may prove valuable.

Cooperation.—Mississippi Experiment Station, and private individuals who will furnish the farms upon which the experiments will be carried out, the cattle, pastures, feeds, and other equipment necessary.

Location.—Canton and Abbott, Miss.

Date begun.—1914.

Results.—This work is a continuation of the work started in 1904 in cooperation with the Alabama Experiment Station and was transferred to Mississippi on June 1, 1914, in order that it might be carried on in counties which have eradicated the cattle tick. For three years feeding experiments with steers were conducted at the Alabama Experiment Station, and an experiment to determine the cost of raising beef cattle and to make a study of the methods of handling them was carried out on a farm in the Tennessee valley. Experimental work was started in Sumter County, Ala., to make a study of the methods of raising, wintering, and fattening beef cattle for the market. These experiments have shown that beef cattle can be raised on grass in summer at less than 5 cents per pound gain. In winter feeding the best results have been obtained with a ration of which silage composes a part, the cost of gain running in some cases below 7 cents per pound. During the winter of 1914–15 there were 75 steers, divided into three lots, used in the experimental work. Despite the fact that the weather was unfavorable for feeding, the daily gains per steer for each lot ranged from 2.02 to 2.04 pounds. These gains were made at a cost ranging from $6.72 to $7.29 per 100 pounds for each lot. At Abbott, Miss., 78 steers and 42 beef calves were used in the experiments. Results of the southern beef-production work have been published in B. A. I. Bulletins 103, 131, 147, and 159 and Department Bulletins 73 and 110.

Probable date of completion.—1920.

Assignment.—W. F. Ward, S. S. Jerden, N. F. Hanson.

Proposed expenditures, 1915–16.—$10,720.

Beef Production in North Carolina:

Object.—To make an experimental study of the problems entailed in maintaining and feeding a herd of breeding cows under conditions existing in North Carolina; to study various methods of wintering beef cattle in North Carolina which are to be subsequently finished for the open market, and to study methods of finishing beef cattle in North Carolina for the market.

Procedure.—A herd of breeding cattle will be kept on a farm under conditions which surround the average stock farms of North Carolina. The herd may be divided into lots for testing various farm feeds for wintering breeding stock most profitably. It will also be used for experiments in determining the costs of raising beef calves to various ages and for determining the feeds which may be used in producing these animals most economically. The same animals will later be fattened on various feedstuffs for market. Some will be fed during the winter, while others may be finished on grass during the summer months. Accurate records will be kept of the amounts of food consumed by each lot, the weights and gains, the cost of production, and any other items which may be of value to the study of these questions.

Cooperation.—With North Carolina Experiment Station, which furnishes a farm with the necessary equipment.

Beef Production in North Carolina—Continued.

Location.—Springfield, N. C.

Date begun.—1913.

Results.—Two lots of beef cattle were fed during the winter of 1913 in comparing corn silage with dry food for fattening steers in the dry lot. Four lots were used in studying economical methods of wintering stocker cattle. During the summer of 1914 feeding on pasture was practiced. During the winter of 1914–15 four lots of stocker cattle were used in comparing methods of wintering cattle. The use of uncut meadow for wintering cattle proved very economical and the steers wintered much better and for about three-fifths of the cost of steers in the dry lot with barn protection. Four lots of cattle were also used in conducting some fattening tests. These gave satisfactory results.

Probable date of completion.—1920.

Assignment.—W. F. Ward, F. T. Peden.

Proposed expenditures, 1915–16.—$1,500.

Live-Stock Transportation:

Object.—To study the loss in weight of live stock in transit and the methods of improving conditions surrounding live-stock shipments.

Procedure.—Carload shipments are studied from starting point to destination and data compiled. It is proposed to continue these studies by using the work already done as a basis and study methods of handling and marketing both cattle and other live-stock shipments to reduce the loss in weight to a minimum.

Cooperation.—Office of Markets and Rural Organization and various railroads and stockyard companies throughout the country.

Location.—Washington, D. C., and the field.

Date begun.—1910.

Results.—The study of the loss in weight of beef cattle in transit covering the Southwest, Northwest, and the corn belt shows that cattle shrank in weight from 3 to 5 per cent of live weight under varying conditions. Shrinkage in hogs was found to be from one-half to 1½ per cent in weight at point of origin. These results are to be used for the information and advice of live-stock shippers so that they may realize the large loss resulting from this source.

Probable date of completion.—July 1, 1916.

Assignment.—W. F. Ward.

Proposed expenditures, 1915–16.—$1,500.

[Extension.]

Live-Stock Production on Irrigation Projects:

Object.—To study conditions existing on irrigation projects which bear upon economical production of swine, cattle, and sheep; to study problems entailed in the raising, wintering, and fattening for market the various classes of live stock especially adapted to conditions existing on irrigated lands; and to carry on demonstrational and educational work among the farmers to induce them to take up live-stock raising and to adopt such methods as may be peculiarly suited to local conditions.

Procedure.—A general survey was made of the North Platte irrigation project to study local conditions and to get into touch with the farmers of the district. A record was made of those farmers who desired to secure live stock and carry on feeding experiments under the supervision of the local live-stock agent. Also, wherever possible, the agent secured records showing the cost of raising, cost of wintering, daily gains, cost of gains, profit on the business, and any other data from the farmers that would help in carrying on the work. The live-stock agent assists in selecting and purchasing animals to be used in the work.

Cooperation.—Bureau of Plant Industry.

Location.—Scottsbluff, Nebr., and other places in the State.

Date begun.—1914.

Assignment.—George M. Rommel, C. S. Jones.

Proposed expenditures, 1915–16.—Cost included under Bureau of Plant Industry project, "Demonstrations on reclamation projects."

Beef-Cattle Extension Work in the Southwest:

Object.—To develop the practice of finishing range cattle for market in the sections where it can be done profitably, to assist farmers in using modern methods, and to demonstrate the use of roughage.

Procedure.—Fifteen counties in the Panhandle of Texas are being visited by Mr. Metcalfe, who has charge of this work in the State. He furnishes plans for silos, feed lots, and sheds; outlines plans for feeding with the ranchmen, making out rations for one or more cattle-feeding demonstrations in the county. As a rule, two or more lots are fed on the same place for comparison. In the counties where there is a demonstration agent, he will look after the carrying out of the plans by cooperating with the demonstration agent. He is able to conduct work on a large number of farms in the Panhandle. By means of circular letters, he keeps ranchmen informed of changes in feeding rations. The work is placed before the public by means of circular letters, newspapers, chambers of commerce, and the railroads.

Cooperation.—States Relations Service, chambers of commerce, agents of the railroads, live-stock men, and ranchmen throughout the Panhandle.

Location.—Headquarters at Amarillo, Tex., from which the work is conducted in 15 counties in the Panhandle.

Date begun.—1914.

Results.—A feeding demonstration was conducted on the farm of Mr. J. M. Neely, near Amarillo, Tex. A feed shed and lots and a silo were constructed at Mr. Neely's expense. Two carloads of steers were divided into lots, and the practice of grazing cattle on the range without feed compared with grazing on pasture supplemented by the feeding of cottonseed cake. These two lots were compared with others in the dry lot on silage made of kafir, milo, and milo heads. The cattle which ran on range had to be sold in January, 1914, as the weather was too severe for grazing long. The feeding of cottonseed cake to cattle on pasture was very profitable—more so than grazing without cake. It was clearly demonstrated that cattle would fatten rapidly on silage and milo maize heads and, under average Panhandle conditions, could be finished at a nice profit. During the spring and summer months a campaign was made for more silos, more silage, and better methods of putting up silage. Mr. Metcalfe aided in the construction of more than 100 silos, furnished plans for feed lots on a number of ranches, and got several feeding demonstrations started in the fall of 1914. He has assisted the ranchmen in purchasing good sires and helped to find purchasers for the surplus stock.

Assignment.—W. F. Ward, T. P. Metcalfe.

Proposed expenditures, 1915–16.—$2,780.

Animal Husbandry Extension Work in Tennessee:

Object.—To give expert advice to county agents and the public generally on improved methods of breeding, raising, feeding, and marketing all kinds of live stock, growing feedstuffs for same, and other matters pertaining to animal husbandry; to advise and assist in the management of pig and lamb clubs and other organizations having for their object the development of animal husbandry in the State of Tennessee.

Procedure.—The specialist who has charge of this work makes visits to farms whose owners are desirous of carrying on demonstration work or who need assistance in animal-husbandry matters. Whenever possible, these visits are made in company with the county demonstration agent, in order that he may be in a position to carry out the instructions given by the specialist. The specialist works out and suggests rations for the economical and efficient feeding of farm work stock, and for more economical production of pork, baby beef, and spring lambs. He encourages the use of pure-bred sires, assists in locating animals for purchasers, and organizes breeding, calf, pig, and lamb and wool clubs. Plans for barns, silos, hog houses, and other farm buildings are furnished or suggested by him, and he also gives information on planning hog pastures and other rotations suited to different kinds of live-stock farming.

Cooperation.—States Relations Service and the extension division of the Tennessee College of Agriculture.

Location.—Knoxville, Tenn., headquarters.

Animal Husbandry Extension Work in Tennessee—Continued.

Date begun.—1914.

Assignment.—W. F. Ward, R. M. Murphy.

Proposed expenditures, 1915–16.—Cost included in project, "Live-stock demonstration work in areas freed from cattle ticks."

Organization of Boys' Pig Clubs:

Object.—Through the organization of pig clubs, to stimulate an interest in swine production and to teach boys improved methods of raising, fattening, and marketing hogs; to instill in the boys, while young, a love of animals which will result in their taking more interest in life upon the farm; and to furnish them at the same time with some work which will, in a practical way, give an insight into the business side of farm life.

Procedure.—The assistant who has charge of the organization of the clubs works in connection with the county demonstration agents in the States which desire such cooperation. Wherever possible, he gains the assistance of the county superintendent of schools, the teachers, and those persons who are in direct contact with boys and other young people. After the formation of clubs, the assistant helps to instruct the boys by sending out circular letters, bulletins, etc., which will aid them in their work. He assists in the purchase of pigs, arranges for exhibits, and helps to secure the prizes which are given at the county and State fairs. Complete records are kept of all phases of the work.

Cooperation.—States Relations Service and the agricultural colleges and experiment stations in States where the work is organized.

Location.—Headquarters, Washington, D. C.; and the States of Louisiana, Alabama, Georgia, North Carolina, Kentucky, Indiana, and Nebraska.

Date begun.—1912.

Results.—The formation of pig clubs was taken up in cooperation with the Louisiana Agricultural College in 1912 and has been successfully organized in six other States. The work has been authorized in Texas and Oklahoma, but as yet no assistants have been appointed in these States. During the calendar year 1914 there were enrolled the following number of members in each of the States named: Louisiana, 3,500; Alabama, 1,900; and Georgia, 981. A fine exhibit of 185 hogs belonging to pig-club members was made at the State fair at Shreveport, La. This exhibit caused much comment because of its excellence. Exhibits were made at the two Georgia State fairs. A good exhibit of meat products made by ham and bacon club members was seen at these fairs. Pig-club work was started also in North Carolina, Kentucky, Indiana, and Nebraska.

Assignment.—W. F. Ward, leader; J. C. Ford, Alabama; J. E. Downing, Georgia; J. D. McVean, North Carolina; Otis Kercher, Kentucky; F. M. Shanklin, Indiana; J. G. McMillan, Nebraska; W. H. Balis, Louisiana.

Proposed expenditures, 1915–16.—$28,400.

Total, Live-Stock Investigations and Demonstrations, $53,040 (research, $21,860; extension, $31,180).

HORSE AND MULE INVESTIGATIONS.

Supervision:

Object.—The general supervision of the work in horse and mule investigations, correspondence, and record files pertaining to same.

Location.—Washington, D. C.

Date begun.—1904.

Assignment.—G. Arthur Bell.

Proposed expenditures, 1915–16.—$4,900 (research, $2,450; extension, $2,450).

[Research.]

Study of Horse and Mule Raising and Feeding:

Object.—To study the economy of feeding and raising horses in the tidewater section of Maryland, and to compare the relative economy of feeding and raising horses and mules.

Procedure.—In the fall of 1912, 20 grade Percheron weanling colts and 20 weanling mule colts of equal quality were purchased. The colts were divided into two lots each and for two winters carried through on silage and hay, with little or no grain, to compare this ration with a hay

Study of Horse and Mule Raising and Feeding—Continued.

and liberal grain ration. During the summer of 1913 one lot was carried through on pasture alone and the other lot on pasture and a fair amount of grain. In the summer of 1914 the same plan was followed. During the winter of 1914–15 one lot was carried through on silage and hay with very little grain and the other on hay and a liberal grain ration. This experiment is to be closed January 1, 1916, and some of the horses and mules retained for future breeding, feeding, and work experimental purposes. After the close of the experiment the results will be prepared for publication.

Location.—Beltsville, Md.

Date begun.—1912.

Results.—Nothing to report until the experiment is closed.

Probable date of completion.—January 1, 1916.

Assignment.—G. Arthur Bell, V. G. Stambaugh.

Proposed expenditures, 1915–16.—$3,000.

Breeding American Carriage Horses:

Object.—To produce a breed of horses from American material suitable for carriage and general purposes.

Procedure.—This work was started by the purchase of six Standardbred mares in December, 1904. A second purchase was made in February, 1905, of the Standardbred stallion Carmon and 12 mares, most of them bred in the corn-belt States and Kentucky. Other mares were added in June, 1906, and four more in March, 1908. Only the best individuals are retained for this work, and those which are not needed are sold at public auction each year. About 35 mares and 4 stallions are in the stud. These mares were bred to the department stallions during the 1915 spring breeding season. The stallions are also available for public service, and a number of outside mares will be bred to them. One or two of the stallions will be sent to other localities in Colorado.

Cooperation.—Colorado Experiment Station.

Location.—Fort Collins, Colo.

Date begun.—1904.

Results.—The type is being reproduced and stallions are being sent out from the station. Three stallions bred at the station were sent out for the spring season in 1914. One was sent to Akron, Colo., one to Falcon, Colo., and one to Rock Springs, Wyo. Very favorable progress has been made. One of the stallions produced in this work is Albion, foaled in 1906, a beautiful bay, weighing 1,380 pounds and standing 16½ hands high. This stallion, on account of his size, good disposition, and general high quality, is extremely popular among the farmers in that vicinity and is producing excellent colts. The mares in the stud will average better than 1,100 pounds and about 15¾ hands high.

Assignment.—G. Arthur Bell, William P. Little.

Proposed expenditures, 1915–16.—$7,900.

Breeding Horses under New England Conditions:

Object.—To breed horses under New England conditions, establishing a stud and using horses of Morgan descent as the foundation. The market requirements and those of the New England farmers are kept in view. A larger horse than the old Morgan will be selected, namely, one standing about 15.2 hands and weighing from 1,005 to 1,100 pounds.

Procedure.—Arrangements were made with the Vermont Experiment Station in the fall of 1905 to start this work on the station farm. The first purchase of stock was made in June, 1906, when seven mares and two fillies were bought from various persons in Vermont. In making the selections for the Morgan stud the effort was made to get the true Morgan type with an increase in size and quality over that possessed by the old Morgan. The stallion General Gates was purchased to head the stud in July, 1907, and later in the year two mares were added. Mr. Joseph Battell, of Middlebury, Vt., presented to the department a 400-acre farm in 1907, on which the work could be conducted to better advantage than on the farm of the Vermont Experiment Station at Burlington, where the soil is very sandy and conditions not entirely suited to horse breeding. The stud was transferred to the department's farm, but the work is still cooperative. Silage has been fed with good

Breeding Horses under New England Conditions—Continued.

results to the brood mares and some of the young stock, as well as the stallions. The coming winter the plan is to divide the mares into two groups, one of which will receive a liberal allowance of silage and the other no silage, with a view to ascertaining the value of silage for this purpose and to make a careful investigation of its effect on the size of the foals produced.

Cooperation.—Vermont Experiment Station.

Location.—Morgan horse farm, Middlebury, Vt.

Date begun.—1906.

Results.—The work has progressed until it has reached the point where it is possible to send out stallions bred at the Morgan horse farm to stand in various localities in Vermont and New Hampshire. As the number of stallions increases they will be sent to other States. It is also possible to dispose each year of some females as registered mares. In March, 1915, one of the stallions was sent from the farm to Rutherfordton, N. C., at the expense of the North Carolina people. Stallions of other breeds have been tried at this place, but the results have not been satisfactory.

Assignment.—G. Arthur Bell, W. F. Hammond.

Proposed expenditures, 1915–16.—$15,900.

Breeding Gray Draft Horses:

Object.—To establish a breed of gray American draft horses by uniting the best qualities of Clydesdale and English Shire horses.

Cooperation.—Iowa Experiment Station.

Location.—Ames, Iowa.

Date begun.—1907.

Results.—Considerable progress has been made, and a large number of the progeny is gray. Of those which are not gray, bay predominates.

Assignment.—G. Arthur Bell.

Proposed expenditures, 1915–16.—No allotment; work depends on obtaining support from other projects.

[Extension.]

Breeding Horses for Military Purposes:

Object.—To encourage the breeding of horses suitable for military purposes in localities where such horses are the most profitable type for farm use, and to encourage in general better horse breeding methods among farmers.

Procedure.—The department places approved stallions in selected communities which are made available to owners of approved mares on the following terms: Service free in return for an option on the resulting foal during the year it is 3 years old at $150. The owner of the foal may be released from his option at any time upon payment of the stipulated service fee. No fee is charged if the Government declines to purchase the foal.

Cooperation.—War Department.

Location.—Three horse-breeding districts have been organized, as follows: First, Vermont and New Hampshire, headquarters at Middlebury, Vt.; second, Virginia and West Virginia, headquarters at Front Royal, Va.; third, Kentucky and Tennessee, headquarters at Lexington, Ky.

Date begun.—1912.

Results.—Under the specific appropriation made by Congress for the Department of Agriculture for the fiscal year 1913, 34 stallions were purchased. These, with 5 stallions from the Morgan horse farm and 6 donated, gave the department 45 stallions. During the 1913 season 42 stallions were stood, 1,579 mares being bred—an average of 37½ per stallion. During the 1914 spring season 43 stallions were in service, 2,013 mares being bred—an average of 47 mares per stallion. On account of the lack of funds there will be but 37 stallions available for the 1915 season.

Assignment.—G. Arthur Bell, leader; W. F. Hammond, in charge of first district; H. H. Reese, second district; R. C. Lawton, third district.

Proposed expenditures, 1915–16.—$26,800.

Breeding Horses on Indian Reservations:

Object.—To improve the quality of horses bred on Indian reservations by proper selection and the use of pure-bred stallions.

Procedure.—In 1913 four light (2 Standardbred and 2 Saddle) and 4 draft (Percheron) stallions and 4 draft (Percheron) mares were purchased with money from the tribal funds of the Indians. It is hoped that this project can be developed so that all stallions used on Indian reservations may be purchased direct from breeders by competent Government officers, so that the breeding work done on the reservations may be supervised by the proper Government officials.

Cooperation.—Interior and War Departments.

Location.—Cheyenne River Agency, S. Dak.

Date begun.—1913.

Results.—A horse barn has been built and pastures fenced. During the 1914 season 256 mares were bred. Definite reports have not been received for the 1915 season. The work is progressing very favorably and is popular among the Indians.

Assignment.—G. Arthur Bell, R. H. Treacy.

Proposed expenditures, 1915–16.—$1,020.

Total, Horse and Mule Investigations, $59,520 (research, $29,250; extension, $30,290).

POULTRY INVESTIGATIONS.

Supervision:

Object.—The general supervision of the work in poultry investigations; correspondence and record files connected with these projects.

Location.—Washington, D. C.

Date begun.—1908.

Assignment.—H. M. Lamon.

Proposed expenditures, 1915–16.—$3,650 (research, $1,825; extension $1.825).

[Research.]

Poultry Feeding:

Object.—To study the cost of buying, fattening, and dressing chickens under commercial conditions; to compare the efficiency of various fattening rations, including the operation of poultry-fattening stations; to select birds for fattening, and to compare the cost of various farm rations for poultry, the advantages of the different methods of handling, and the effects of such rations, including the cost of egg production.

Procedure.—The birds are selected and put into colony houses, either on free range or in yards, and fed rations whereby comparisons can be made. Packing houses, feeding stations, and private plants have been visited to collect data of importance to the carrying out of the objects of this project.

Cooperation.—State experiment stations, agricultural colleges, various packing companies, and farmers.

Location.—Washington, D. C.; Beltsville, Md.; and the field.

Date begun.—1910.

Results.—B. A. I. Bulletin 140 shows that the cost of poultry feeding at various plants varies from 6.45 cents per pound gain in one case to 7.74 cents in another. The cost of both feed and labor to produce a pound of gain averaged 7.85 cents in one case and 10.33 cents in another, the average cost being 9.09 cents per pound gain, including the cost of feed and labor. Department Bulletin 21 continues and enlarges the work described in B. A. I. Bulletin 140. Four years' work has been completed at Beltsville. The pens have been increased to 16, with a total of about 260 fowls. Previous experiments comparing poultry rations are being continued with 2 and 3 year old hens, and new work has been started in studying the use of cottonseed meal and fish scrap. Results of the first two years' work on this experiment are being prepared for publication.

Assignment.—H. M. Lamon, A. R. Lee.

Proposed expenditures, 1915–16.—$4,120.

Poultry Breeding:

Object.—To produce first-class individuals of leading breeds of farm poultry to be used in poultry investigations at the bureau experiment farm, Beltsville, Md.; to determine the possibility of producing high-class specimens

Poultry Breeding—Continued.

of barred Plymouth Rocks by single mating; to establish a breed having the long type of body like the Dorking, having four toes, yellow skin. and which will lay a white-shelled egg; to study what influence the male and female have in transmitting their egg-laying qualities to their offspring, and to work out methods which can be used to increase the laying qualities and the size of the eggs of the average flock.

Procedure.—Matings are made and chickens hatched and reared from the best specimens of the different varieties kept, with a view to producing a supply of suitable fowls. All hens in the breeding work are being trapnested and various matings made of this pedigreed stock to attempt to concentrate the blood strains of individuals of high production. Early maturity of pullets is also being used as a basis of selection in attempting to improve egg production. Observations wherever possible are being made on the inheritance of other characteristics. The birds produced will be used at the experiment farm and for the improvement of the poultry industry as the occasion demands, such as for children in the poultry-club work.

Location.—Beltsville, Md.

Date begun.—1912.

Results.—Several hundred fowls, both males and females, were raised, either being put into breeding or feeding pens or reserved for future use. Many of these specimens were of excellent quality. Trap-nest records of all hens used in the breeding work have been secured. Chickens are being reared from the various matings to continue the work. The blood of one particular Rhode Island Red male has been discovered to be strong in ability to produce good laying pullets, and an attempt is being made to concentrate this blood. In the formation of the new breed individuals with yellow legs, four toes, white plumage, and good type have been produced. A few red-ear lobes have also been produced. Not all of these characteristics have been secured in the same individual to any extent as yet.

Assignment.—H. M. Lamon, R. R. Slocum.

Proposed expenditures, 1915–16.—$4,960.

Improvement of the Market Egg:

Object.—To study conditions surrounding the production of the market egg from the farm to the country store.

Procedure.—A general survey of the field of greatest poultry and egg production was made in the spring and summer of 1908. This was followed by the organization of the egg buyers in the State of Kansas to purchase eggs on the loss-off basis. In this campaign the assistance of poultry-club workers, farmers, and other producers and handlers of eggs was enlisted. It is not proposed to contract any expense for this project for which definite allotment should be made during the fiscal year 1916.

Cooperation.—Office of Markets and Rural Organization, Bureau of Chemistry, States Relations Service, State boards of health, State agricultural colleges, poultry packers, farmers, railroads, and country store merchants.

Location.—Washington, D. C., and throughout the United States.

Date begun.—1908.

Results.—B. A. I. Bulletin 140 shows the results of the survey made in 1908, and B. A. I. Bulletin 141 gives in detail the effort put forth to study the factors influencing the quality in eggs and the conditions surrounding their production. An egg placard, which shows the egg in various stages of incubation, was prepared and has proved of very valuable assistance in the campaign for better market eggs. These placards were sent out to the various cooperators, who placed them in conspicuous places for the information of the producer and the general public. They will be sent to postmasters or others interested if found necessary. A miniature of this placard is contained in Farmers' Bulletin 528. "Rooster Day" was inaugurated and proved a prime feature in the campaign for infertile eggs.

Assignment.—H. M. Lamon.

Proposed expenditures, 1915–16.—No allotment; work depends on obtaining support from other projects.

Incubation of Eggs:

Object.—To study the problems underlying the incubation of eggs, both by natural and artificial means; to study the incubation of hens' eggs by the use of the respiration calorimeter; to find out what takes place during incubation and determine particularly the cause of the poor efficiency of the modern incubator; and to measure the gaseous exchange and heat elimination of eggs in various circumstances affecting their nutritive value, keeping quality, fertility, and other characteristics.

Procedure.—Hens are set and a careful record kept of the temperature maintained by them. Eggs are placed in the incubator and a temperature record kept of them as a comparison. This year the work will be broadened in a study of the work by means of the respiration calorimeter. The results will be used in improving methods of artificial incubation now in vogue.

Cooperation.—Office of Home Economics, States Relations Service.

Location.—Washington, D. C., and Beltsville, Md.

Date begun.—1913.

Results.—Records have been kept of the daily temperature of sitting hens during the period of incubation, and the daily weights of eggs during this period, daily position of eggs in the nest, etc., have been noted.

Assignment.—H. M. Lamon, Bureau of Animal Industry; R. D. Milner, States Relations Service.

Proposed expenditures, 1915–16.—$2,100.

Turkey and Guinea Investigations:

Object.—To study methods of incubation, breeding, feeding, housing, and management of turkeys and guinea fowls.

Procedure.—A survey is being made of the districts where these birds are raised or have been raised in large quantities, to determine the nature of the difficulties which have seriously affected the industry in certain portions of the United States. A man has been placed upon a farm where large numbers of turkeys are kept to assist in raising them and to get an insight of their habits. In the fall of 1915 he will follow a shipment of birds from various farms to New York City.

Location.—Washington, D. C., and the field.

Date begun.—1914.

Results.—In the fall of 1914 an assistant followed a shipment of turkeys and collected data for the project. The experiment has not progressed sufficiently to report in detail.

Assignment.—H. M. Lamon, A. S. Weiant.

Proposed expenditures, 1915–16.—$1,750.

Management of Turkeys to Prevent Disease:

Object.—To work out methods for the control and prevention of excessive mortality among turkeys.

Procedure.—Necessary investigations relating to bacterial diseases and parasites will be carried on by the Pathological and Zoological Divisions of the Bureau of Animal Industry. On the basis of the results obtained from these investigations the Animal Husbandry Division will conduct field trials and demonstrations to determine methods of management necessary to establish freedom from disease infection.

Location.—Washington, D. C., and the field.

Date begun.—1914.

Results.—Results of disease investigations reported under group "Investigations of animal diseases."

Assignment.—H. M. Lamon.

Proposed expenditures, 1915–16.—No allotment; cost included under project "Turkey and guinea investigations."

Ostrich Investigations:

Object.—To study the problems underlying the breeding, incubation, and feeding of ostriches in the United States; to cooperate with the Pathological Division in studying the diseases and climatic conditions affecting them; to study the marketing of feathers, and to assist ostrich breeders in the preparation of their product for market.

Procedure.—This work was begun by making a study of grading and marketing feathers in New York, N. Y., in December, 1913. In January, 1914, several matings of different varieties of ostriches were made. The birds

Ostrich Investigations—Continued.

were fed different rations to determine what effect feeding has upon the improvement in the quality of the feathers produced. The feeding experiments will be continued this year.

Cooperation.—Arizona Ostrich Breeders' Association.

Location.—Cashion, Ariz.

Date begun.—1913.

Results.—The work has not progressed sufficiently to report any results.

Assignment.—H. M. Lamon, G. L. Griffith.

Proposed expenditures, 1915–16.—$2,500.

[Extension.]

Organization of Boys' and Girls' Poultry Clubs:

Object.—Through the organization of poultry clubs, to stimulate an interest in poultry among farm boys and girls; to give a better knowledge of the value and importance of the poultry industry; to encourage better poultry management and the breeding of standard-bred poultry; to standardize poultry and poultry products, and to show how increased revenue may be obtained by marketing a first-class uniform product.

Procedure.—At the request of a State, through the proper extension department, the bureau details a poultry-club agent to serve in the State as a member of the extension department. His duties are to demonstrate to the county agents how poultry clubs are to be organized and to interest such agents in the principles of poultry husbandry. It is proposed to extend this work as appropriations permit, so that young people and all others interested may be organized into poultry clubs in the States in which the department has demonstrations in progress. It is also proposed to demonstrate the practicability of poultry production in sections where it is not now carried on extensively and to improve the quality of the output of the farm.

Cooperation.—States Relations Service, agricultural colleges and experiment stations, poultry and egg shipping associations, and breeders of standard-bred poultry.

Location.—Washington, D. C.; Virginia, Kentucky, Tennessee, North Carolina, South Carolina, and Georgia.

Date begun.—The work was started in Virginia in October, 1912; in South Carolina, December, 1913; in North Carolina, January, 1914; in Tennessee and Kentucky, February, 1914; and in Georgia, September, 1914.

Results.—The State of Virginia was organized in 1912 and the report for 1913 gave 153 members in 12 clubs in 4 counties. At present 13 counties are organized, with 383 members. South Carolina is organized in 7 counties and has 549 members. North Carolina has 600 members. Tennessee is organized and has 800 members. Kentucky has 322 members in 8 counties, and Georgia has 534 members in 13 counties. The work has progressed very favorably in all of the States, and in some exhibits have been made and prizes offered for the best birds. The total value of the awards for 1914 at various exhibits was $779.

Assignment.—H. M. Lamon, leader; J. W. Kinghorne, in charge, Virginia; C. C. Cleveland, South Carolina; A. G. Oliver, North Carolina; L. J. Brosemer, Tennessee; H. W. Rickey, Kentucky; D. J. Taylor, Georgia.

Proposed expenditures, 1915–16.—$16,060.

Total, Poultry Investigation, $35,140 (research, $17,255; extension, $17,885).

[Research.]

SHEEP AND GOAT INVESTIGATIONS.

Breeding Range Sheep:

Object.—To produce a type of sheep for range conditions which will shear a profitable amount of wool of long staple, have good mutton conformation, and stand being flocked in large numbers.

Procedure.—For six years the stock used was Rambouillet and Delaine Merino, carefully selected. In the fall of 1912 Cotswold, Lincoln, Leicester, and Romney Marsh rams were introduced. The best ewes in the flock were bred to Rambouillet bucks, the others being bred to the longwool bucks. In 1914 the flock was bred entirely to Rambouillet rams

Breeding Range Sheep—Continued .

to keep up the original project, and only such cross-bred animals will be raised in the future as are necessary to allow selection of the rams needed in fixing the cross-bred type. Breeding records will be kept to furnish data upon the influences controlling the size of the lamb yields under range conditions.

Cooperation.—The project was started in cooperation with the Wyoming Experiment Station. This contract was terminated on June 30, 1910, since which time the work has been cooperative with the F. S. King Brothers Co., Laramie, Wyo.

Location.—Laramie, Wyo.

Date begun.—1906.

Results.—The records show an increase in the shearing yields and a marked variation in the fleece weights of the progeny of the various rams used. High-class bucks have been distributed among the ranches of the West and the sheepmen given instruction in the proper methods of handling sheep on the range. Valuable data have been secured relative to yields of lambs and wools from range flocks in different seasons and to other practical factors in range-sheep management. The flock is approaching a type commonly admitted to be desirable, but not produced by individuals dependent upon seasonal fluctuation in extent of demand and kind of sheep sought for as a means of meeting temporary conditions.

Assignment.—F. R. Marshall, L. L. Heller.

Proposed expenditures, 1915-16.—$4,200.

Study of Adaptability of Corriedale Sheep to American Range Conditions:

Object.—To study the value of the Corriedale breed as a combination wool and mutton sheep for the range sections of the United States.

Procedure.—The leader of this project visited New Zealand in the fall of 1914 to study the Corriedale flocks and the conditions under which they are kept. An importation of 64 Corriedale sheep was made in January, 1915, followed by another of 12 sheep in April, 1915. These sheep will be placed on a typical sheep ranch to determine whether they will thrive and prove as valuable in this country as they are in New Zealand. They will be cared for the same as the sheep owned by the Division of Animal Husbandry, at Laramie, Wyo., running upon the open range except in the breeding and lambing season. All Corriedale ewes will be bred to rams of the same breed. The weights, losses, and yields of wool and lambs will be compared with those for the Rambouillets in the same flock. If found desirable, as soon as the Corriedale flock is large enough to be divided, arrangements will be made to place smaller flocks upon ranges located upon ranches having altitudes higher or lower than at Laramie and with different kinds of grazing.

Location.—Laramie, Wyo.

Date begun.—1914.

Results.—This is a new project and as yet no results can be shown. As soon as a fair estimate of the usefulness of the breed in this country can be made data pertaining thereto will be published.

Assignment.—F. R. Marshall, L. L. Heller.

Proposed expenditures, 1915-16.—$800.

Breeding Sheep under New England Conditions:

Object.—To encourage New England farmers to return to sheep breeding and to furnish data as to returns from the practical management of farm flocks in New England.

Procedure.—A flock of 60 Southdown ewes to be kept at the Morgan horse farm, Middlebury, Vt. It is proposed to conduct experiments with the flock in testing the best methods of using forage crops for fattening lambs and maintaining ewes in summer.

Location.—Morgan horse farm, Middlebury, Vt.

Date begun.—1907.

Results.—Rams have been sold to the farmers in the surrounding country for the improvement of their stock. The feasibility of protecting sheep from dogs and of keeping them healthy by changes of pasture and rotation of forages has been demonstrated.

Assignment.—F. R. Marshall, L. L. Heller.

Proposed expenditures, 1915-16.—$1,000.

Breeding an Early-Lambing Type of Mutton Sheep:

Object.—To combine the Barbados's remarkable fecundity and tendency to breed in any month with the conformation of the Southdown and to procure data upon the inheritance of prolificacy. Incidentally sheep of this experiment are used in a study of a system of intensive grazing upon limited areas of forage crops.

Procedure.—The project was originally planned for the crossing of Barbados ewes with Merino rams. The work was started at the bureau experiment farm, at Bethesda, Md., and transferred to the Beltsville (Md.) farm in June. 1911. A Southdown ram was used in 1910 and 1911 for crossing on the Barbados ewes. Because of the fact that fire destroyed the sheep barn and breeding stock on March 31, 1915, this experiment has been interrupted for the present, but the plan is to continue it along the same lines in order to study the inheritance of prolificacy and to select and fix a type combining a good mutton conformation with the breeding habit of the Barbados.

Location.—Beltsville, Md.

Date begun.—1907.

Results.—Two generations of the Southdown-Barbados have been obtained. The ewes are less prolific than the Barbados but more so than the Southdowns or Merinos used at the start.

Assignment.—F. R. Marshall, V. O. McWhorter.

Proposed expenditures, 1915–16.—$270.

Production of Persian-Lamb Fur:

Object.—To determine the possible value for fur of Karakul sheep and their crosses under American conditions.

Procedure.—Ewes of Barbados blood were bred to Karakul rams and their half-bred female offspring to other Karakul rams, the grading to be continued until it can be shown whether sheep so bred are satisfactory as fur producers. The Karakul rams will be crossed with ewes of various breeds, to show the comparative values of the different breeds as dams for fur-producing lambs. On March 31, 1915, the sheep barn and breeding stock at the Beltsville farm were destroyed by fire. As soon as possible the experiment will be resumed under the same general plan.

Cooperation.—The rams have been furnished by outside parties at their own expense.

Location.—Beltsville, Md.

Date begun.—1911.

Results.—Skins obtained from lambs by Karakul bucks out of Barbados, Merino, Cheviot, Cotswold, and Karakul-Barbados ewes indicate that further crosses will produce a sheep that can be profitably used in this country as a fur producer.

Assignment.—F. R. Marshall, V. O. McWhorter.

Proposed expenditures, 1915–16.—$270.

Milch-Goat Breeding:

Object.—To develop profitably milk-producing goats; to study feeding of milch goats and the value of goat's milk.

Procedure.—A flock of goats has been bred up from American stock and these are being crossed with Saanen and Toggenburg bucks. The crossbred does have proved very promising from a milk-producing standpoint. It is planned to keep a flock of 60 head—15 does of milking age with males and young stock of each of the two breeds now on hand. Part of the does will be kept at the Beltsville farm and the balance loaned to families at the direction of selected physicians. In this way data can be obtained as to the use and character of goat's milk through reports from the families having the goats by cooperative laboratory study of the milk produced at Beltsville and by bacterial counts of milk produced from the does milked there and the others which will be returned to Beltsville for breeding while still in milk. Feeding experiments will be continued. A number of kids will need to be raised without milk, if the does leave the farm at freshening, and experiments will be conducted to test artificial feeds for the purpose.

Location.—Beltsville, Md.

Date begun.—1905.

Results.—This work was begun in 1905 in cooperation with the Connecticut and Maryland experiment stations and was transferred to the Beltsville

Milch-Goat Breeding—Continued.

farm in 1911. Milk records were kept of a part of the native common does during 1910 and 1911. Ten half-bred Saanen does came in milk in February and March, 1914. The feed and milk records of these does furnishes a contrast with those of their dams. Eight head of half-bred Toggenburg does came into milk this year. The common does are being eliminated, and in 1916 there will be a flock of around 50 does consisting altogether of half and three-quarter bred Saanens and Toggenburgs.

Assignment.—F. R. Marshall, V. O. McWhorter.

Proposed expenditures, 1915–16.—$1,000.

Classification of Wools:

Object.—To study the classification of wool on the leading markets and the requirements of each class; to determine the possibility of adopting a uniform classification of wool, and to inform growers how wool must be handled to bring its full value when sold.

Procedure.—A collection of wools has been prepared for use in educational work in the field. This collection will be exhibited in the leading wool-producing States, and other forms of demonstrations will be arranged. In May and June, 1915, a close examination will be made of methods of preparation of wool in various sections, and the wool from the bureau's experimental flock at Laramie, Wyo., will be so divided as to show amounts and values of various grades resulting from a more careful preparation of western clips of wool.

Cooperation.—Office of Markets and Rural Organization.

Location.—Washington, D. C.; Boston, Mass.; and the range States.

Date begun.—1913.

Results.—Department Bulletin 206, entitled "The Woolgrower and the Wool Trade," reports the findings of preliminary studies under this project.

Assignment.—F. R. Marshall, L. L. Heller.

Proposed expenditures, 1915–16.—$4,900.

Total, Sheep and Goat Investigations, $12,440.

[Research.]

ANIMAL HUSBANDRY EXPERIMENT FARM.

Animal Husbandry Experiment Farm:

Object.—To furnish facilities for investigations in the feeding and breeding of farm animals, including poultry.

Procedure.—A senior animal husbandman is in charge of the farm and ranks the same as those in charge of specific investigational projects, although he has no direct connection with any research work. Feed crops are being put in and the drainage work is going forward. It is desirable to erect cottages for the employees; a hospital building is also needed.

Location.—Beltsville, Md.

Date begun.—1911.

Results.—Since the farm was started, seven buildings have been erected and roads built. The paddocks have been finished and the drainage of the farm begun. No animal-husbandry results are expected from the farm per se; results are obtained under the direction of men in charge of other projects.

Assignment.—E. L. Shaw.

Proposed expenditures, 1915–16.—$21,480.

[Regulation.]

CERTIFICATION OF PEDIGREES.

Certification of Animals Imported for Breeding Purposes:

Object.—To determine the purity of breeds and the identity of horses, dogs, and cats imported for breeding purposes under the provisions of the tariff act of October 3, 1913.

Procedure.—In accordance with the provisions of paragraph 397 of the tariff act of October 3, 1913, the customs officials require, for the entry free of duty of animals imported for breeding purposes, certificates issued by the Department of Agriculture stating that such animals are pure bred, of a recognized breed, and duly registered in the foreign book of

Certification of Animals Imported for Breeding Purposes—Continued.

record established for that breed. Under authority of this paragraph regulations of this department were issued and designated as B. A. I. Order 206. This order contains a list of the foreign societies recognized by the department and gives detailed directions for obtaining the certificates of pure breeding required by the customs. Upon the arrival of the animals at the port of entry they are examined by a Bureau of Animal Industry official, who reports to the Washington office the breed, sex, age, color, and markings. In case the data on the foreign certificates do not agree with the animal imported the bureau declines to issue the certificate of pure breeding. The pedigree given on the certificates is also checked with the published volumes, and those certificates containing errors are returned for correction. In cases where the papers are found to be satisfactory this bureau issues the certificate of pure breeding and sends it to the collector of customs at the port of entry. The foreign certificate is stamped, showing that this bureau has found all papers satisfactory, and returned to the importer. The work will be continued under the same general plan as outlined.

Location.—Washington, D. C., and places throughout the United States.

Date begun.—1911.

Results.—Under this system of issuing certificates of pure breeding, American buyers, breeders, and record societies are guaranteed that the animals alleged to be imported are as represented. Publication has been made from time to time of lists, giving the name, registry number, importer, port of entry, date of arrival, and the department number of horses and cattle brought into this country. As the tariff act of October 3, 1913, provides for entry free of duty of all cattle, sheep, and swine, certificates of pure breeding are no longer issued by this bureau for those classes. During the calendar year 1914, certificates of pure breeding were issued for 1,195 horses, 597 dogs, and 12 cats. B. A. I. Orders 130, 136, 175, 186, and 206, with amendments, have been published in connection with this work of certification of pedigrees.

Assignment.—G. Arthur Bell, Charles C. Glenn.

Proposed expenditures, 1915–16.—$3,000.

Total, Animal Husbandry Investigations, $209,340 (research, $118,845; extension, $86,835; regulation, $3,660).

[Research.]

INVESTIGATIONS OF ANIMAL DISEASES.

Supervision:

Object.—Supervision of all the investigations of animal diseases and the performance of duties common to this work.

Location.—Washington, D. C.

Date begun.—1884.

Assignment.—M. Dorset, A. Eichhorn, B. H. Ransom, E. C. Schroeder.

Proposed expenditures, 1915–16.—$10,000.

Rabies Investigations:

Object.—(1) The diagnosis of rabies in animals; (2) study of the disease to find the causative agent and to be able to grow this agent by laboratory methods; (3) determination of the significance of Negri bodies as to the causation of rabies.

Procedure.—(1) After procuring the head of an animal suspected of being affected with rabies smear preparations or sections of brain tissues are stained and examined to detect the presence of Negri bodies, which are considered diagnostic for rabies; the intracerebral injection of nervous tissue into healthy rabbits or guinea pigs to determine a case of rabies not diagnosable by the above method; the microscopic examination of the nervous tissues of rabbits dead from the inoculation with suspected rabies material from other animals. (2) The actual causative agent being in dispute, importance of suspected agents, for instance, Negri bodies, bacilli, etc., is determined by the growing of these agents in artificial culture media, by isolating them in pure culture, growing them again, then through subsequent inoculations of susceptible animals with this growth in an endeavor to engender a typical case of rabies. (3) The study of the relation of Negri bodies to the disease is made by elimination of all

Rabies Investigations—Continued.

material except these bodies, if this be possible, and the injection of these bodies alone into animals.

Location.—Washington, D. C.

Date begun.—1893.

Results.—During the fiscal year 1914 there were received for diagnosis 183 brains from suspected cases of rabies. Of these, 110 dogs, 8 cows, 1 horse, 2 mules, and 3 cats were found to be affected.

Assignment.—J. S. Buckley, B. A. Gallagher, R. F. Formad.

Proposed expenditures.—$2,800.

Serum Diagnosis of Dourine:

Object.—To determine the presence or absence of dourine in suspected animals.

Procedure.—Samples of blood serums from suspected cases of disease forwarded to the bureau by State veterinarians and their deputies and field men in the employ of the Bureau of Animal Industry are submitted to the complement-fixation test to establish the presence or absence of the disease.

Cooperation.—Office of Indian Affairs, Interior Department, and various officials in the States in which the work is conducted.

Location.—Washington, D. C.

Date begun.—1913.

Results.—Estimated number of suspected cases of dourine diagnosed per annum, 80,000.

Assignment.—J. M. Buck, H. W. Schoening.

Proposed expenditures, 1915–16.—$12,000.

Diagnosis and Investigation of Diseases of Animals Confined in the United States National Zoological Park:

Object.—To determine the specific nature of the diseases which affect the Zoological Park animals, for the purpose of controlling these diseases.

Procedure.—Animals suffering from diseases are observed and treated. Animals that die are autopsied and when necessary a histologic study is made of the lesions which are present. When obscure diseases or conditions are met with, a bacteriologic investigation is instituted and animal inoculation may be resorted to for the purpose of determining the infectious nature of the disease.

Cooperation.—Smithsonian Institution.

Location.—Washington, D. C.

Date begun.—1899.

Results.—A large number of birds and other animals were received for autopsy, and opportunity was afforded for study of certain diseases of obscure etiology.

Assignment.—B. A. Gallagher.

Proposed expenditures, 1915–16.—$300.

Forage Poisoning or Cerebrospinal Meningitis of Horses:

Object.—To determine the causative agent, devise measures for prevention, and detect and study the lesions of this disease.

Procedure.—The feeding materials or water that are suspected of being responsible for the disease are observed and studied. Laboratory bacteriological examination of animal fluids and tissues obtained from animals dead of the disease are made. Pathological examinations of the affected tissues are also conducted. By a study of the disease advice can be given to horse owners which may enable them to guard against the occurrence of the disease, as when the disease is recognizable it has passed beyond the present powers of help. By a study of the lesions of the disease it may be possible to determine whether hitherto unsuspected factors play any part in its causation. Inoculation experiments on horses of the fluids from a diseased horse or of bacterial cultures of diseased horses are made.

Location.—Washington, D. C.

Date begun.—1884.

Results.—Autopsies on affected animals have occasionally shown lesions of the central nervous system, parasitic aneurisms of the mesenteric arteries, parasitic infestations and inflammation of cæcum and large intestines, etc.

Assignment.—John S. Buckley.

Proposed expenditures, 1915–16.—$2,100.

Demonstration of Tubercle Bacilli in the Tissues of Cattle That Have Reacted to Tuberculin:

Object.—When animals have been slaughtered because they gave a positive reaction to the tuberculin test and subsequent post-mortem examination fails to reveal definite tuberculous lesions, laboratory examination frequently detects tuberculous foci that have escaped clinical examination. This is desirable as a verification of the tuberculin test.

Procedure.—The most suspicious appearing portions of the available tissues are macerated in a mortar, the resulting emulsion is then filtered through absorbent cotton, and the sediment is examined with the microscope. Should no tubercle bacilli be found, test animals are inoculated with the emulsion. The development of tuberculous growths substantiates the tuberculin test and affords a valuable basis in the settlement of indemnity claims for the slaughter of suspected cattle.

Location.—Washington, D. C.

Date begun.—1900.

Results.—Investigation of glands from cattle that have reacted to tuberculin but in which no visible lesions of tuberculosis could be detected show that fully one-half of such carcasses contain tubercle bacilli.

Assignment.—H. J. Washburn.

Proposed expenditures, 1915–16.—$500.

Propagation of Acid-Fast Bacilli:

Object.—To have always available a collection of tubercle bacilli of the various types—human, bovine, and avian—that they may be furnished to medical schools and bacteriological laboratories for purposes of study and comparison, and also to manufacturers of biological products to serve as foundation cultures in the manufacture of tuberculins. Numerous closely related organisms, including the leprosy bacillus, the timothy bacillus, the butter bacillus, etc., are cultivated and kept continuously available as stock cultures for use in comparative studies.

Procedure.—Living cultures of known origin are transplanted every six to eight weeks upon freshly prepared media and allowed to grow in an incubator for 10 to 15 days, when they are removed and kept at room temperatures until needed.

Location.—Washington, D. C.

Date begun.—1901.

Results.—About 100 different strains of acid-fast bacilli have been cultivated and studied.

Assignment.—H. J. Washburn.

Proposed expenditures, 1915–16.—$500.

Producing Strains of Animals Immune to Tuberculosis:

Object.—To find the occasional animals which strongly resist tuberculosis and, by inbreeding these animals, produce families or breeds which are highly resistant.

Procedure.—Preliminary experiments involve the inoculation of a large number of small animals, as rabbits, with tubercle bacilli. All but the occasional animals which show highest resistance are discarded. These resistant animals are interbred so as to produce a large number of their progeny. The latter are inoculated and only those of highest resistance saved. Thus in this preliminary experiment the aim is to discover whether it is practicable to breed for immunity and also to devise methods of doing the work with cattle and swine. Permanent experiments with cattle and swine are planned. Families and breeds of cattle and swine which rarely or never have tuberculosis will be sought by every method possible. It may be that post-morten examinations can be recorded in case of promising families, as families of Shorthorns and Holsteins or others breeds of cattle, to be used as evidence as to whether other lesions show that there has been tuberculous infection. It may be necessary to find some means of keeping a record as to whether the animals on given farms have been subject to infection. Probably in both the permanent and the preliminary experiments it will be necessary to find mutating animals which are especially efficient in begetting resistant progeny.

Location.—Washington, D. C.

Date begun.—1913.

Producing Strains of Animals Immune to Tuberculosis—Continued.

Results.—Rabbits have been immunized and young animals produced by them are being kept for future study.

Assignment.—H. J. Washburn.

Proposed expenditures, 1915–16.—$400.

Production of Preventive and Curative Bacterins for Takosis of Goats:

Object.—To manufacture bacterins for the prevention and cure of takosis in goats and to distribute the same to owners and managers of flocks that become affected with this disease.

Procedure.—To obtain from the visceral organs of a goat dead with takosis a culture of *Micrococcus caprinus;* isolate this organism in pure culture; propagate the pure culture and from bouillon subcultures manufacture bacterins which may be applied to affected goats by means of subcutaneous inoculations.

Location.—Washington, D. C.

Date begun.—1912.

Results.—Bacterins have been found very reliable in checking and curing outbreaks of takosis.

Assignment.—H. J. Washburn.

Proposed expenditures, 1915–16.—$350.

Investigation of Means of Utilizing City Garbage and Table Refuse:

Object.—City garbage and the refuse from the tables and kitchens of large hotels and eating houses contain very material values as food for swine. It is essential, however, to so treat this material before feeding it that it can not serve as a means of transmitting disease to the animals with which it comes in contact.

Procedure.—Ascertain the degree of heat required to destroy any germs of tuberculosis or hog cholera that may be in the garbage; determine the amount of cooking which will prove profitable from the feeder's standpoint; devise means for keeping the garbage free from harmful amounts of caustics and soaps and for keeping the containers in which the garbage is stored clean and free from fermentation.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Garbage when sterilized has been proved excellent as food for swine.

Assignment.—H. J. Washburn, J. S. Buckley.

Proposed expenditures, 1915–16.—$500.

Investigation of Infectious Abortion of Animals:

Object.—To gain further knowledge concerning the etiology, mode of transmission, and practicable means of eradicating the disease; to devise the most satisfactory method of disinfecting contaminated premises; and to determine the presence of the bacillus in suspected samples of market milk.

Procedure.—Material is obtained from aborting females of different species; cultures are isolated from each and these cultures studied comparatively. Various methods of diagnosis and of prevention are tested and efforts made to devise new procedures for diagnosis, prevention, and cure.

Cooperation.—New York State Veterinary College.

Location.—Washington, D. C.; Bethesda, Md.; and Ithaca, N. Y.

Date begun.—1908.

Results.—One herd of nearly 100 cattle, in which abortions formerly occurred frequently, after two years of treatment under the direction of the bureau has passed over several months without a single abortion. It has been demonstrated that the bacillus of infectious abortion occurs in the milk of infected cows; that infected cows remain permanent carriers of the infection long after seeming recovery; that animals that do not seem to find the *Bacillus abortus* specifically pathogenic may also serve as carriers; that a fairly large proportion of cows are naturally immune to abortion, and that this immunity may be transmitted to their progeny; that exposure to other natural means than copulation and ingestion is not a serious danger unless it occurs shortly before or after parturition; and that satisfactory medicinal treatment of the disease remains to be discovered.

Assignment.—E. C. Schroeder, A. Eichhorn, W. L. Williams.

Proposed expenditures, 1915–16.—$11,100.

Contagious Mammitis:

Object.—To determine the causative agent and produce biologic products for prevention and treatment.

Procedure.—Secretions from affected udders are collected with due precaution to eliminate extraneous contamination; cultures made and organisms isolated; large quantities of the suspected organism grown on artificial media, killed by heat, for use in this investigation. Another method is to collect milk, pour off supernatant serum, sterilize at low temperature, and mix with equal parts of a suspension of the dead organisms. These materials may then be injected at various intervals into affected and exposed cattle.

Location.—Washington, D. C.

Date begun.—1912.

Results.—Milk from approximately 50 cases of mammitis was examined and cultures of the invading streptococci made, but in no instance was the development of pathologic lesions caused by the inoculation of laboratory animals with the recovered organisms.

Assignment.—G. M. Potter.

Proposed expenditures, 1915–16.—$300.

Investigation of the Birth of Immature and Hairless Pigs and Other Animals and of Goiter in Kids and Lambs:

Object.—To determine the causative agent and to devise preventive procedures.

Procedure.—Samples of serum from affected animals will be subjected to serologic tests. If suspected causative agents are obtained, it is desired to expose pregnant females to these suspected causes.

Location.—Washington, D. C.

Date begun.—1913.

Results.—Ten hairless pigs have been submitted for examination, and the application of the complement-fixation test to their blood demonstrated the absence of the bacillus of infectious abortion in nine of the cases.

Assignment.—G. M. Potter.

Proposed expenditures, 1915–16.—$250.

Investigation of Swamp Fever:

Object.—To determine the nature, cause, and prevention of so-called swamp fever of horses, particularly to establish an accurate method of laboratory and clinical diagnosis. This involves a general study of the so-called filterable or ultravisible viruses and new methods of procedure in diagnostic technique.

Procedure.—Inoculation experiments and observations of field cases will be made. From these results material is to be obtained for laboratory tests in diagnosis, either by complement-fixation test or otherwise. The possibility of insect transmission will be determined by field observation and by exposure of susceptible horses to various insects.

Cooperation.—Minnesota Experiment Station and Minnesota Live-Stock Sanitary Board.

Location.—Washington, D. C., and St. Anthony Park, Minn.

Date begun.—1906.

Results.—It has been proved that the infection is not carried by stable flies or the common house fly.

Assignment.—C. F. Flocken.

Proposed expenditures, 1915–16.—$2,600.

Hemorrhagic Septicemia Investigations:

Object.—To establish a method of immunization in the control of the disease.

Procedure.—Different strains of the *Bacillus bipolaris bovisepticus* are isolated and attenuated by growing them at a temperature of 42° to 43° C. for two and five days, respectively. The cultures in which the attenuation is carried on for five days serve for the preparation of Vaccine I, and from the less attenuated cultures Vaccine II is prepared. The injections with the vaccines are given 10 days apart. Competent veterinarians are furnished with these vaccines for the control of outbreaks of hemorrhagic septicemia in cattle with the request that they report the results of the vaccination. The vaccine has also been used in the outbreak of hemorrhagic septicemia among the buffaloes in the Yellowstone National Park.

Hemorrhagic Septicemia Investigations—Continued.

The results appear to be uniformly satisfactory. It is now aimed to establish the duration of the immunity by this method of vaccination and also to study the results of similar vaccinations with the *Bacillus bovisepticus* on the same disease in sheep.

Location.—Washington, D. C.

Date begun.—1912.

Results.—An effective bacterin for the control of hemorrhagic septicemia has been prepared.

Assignment.—A. Eichhorn.

Proposed expenditures, 1915–16.—$100.

Investigation of Malta Fever:

Object.—To establish the extent of the disease among the goats in the United States and to undertake immunizing experiments with vaccines prepared from the *Micrococcus melitensis*.

Procedure.—Blood samples are procured from the infected localities and tested by the complement-fixation and agglutination tests for the presence of Malta fever. Goats are infected at the Beltsville experiment station and bacteriological tests made of their excretions and secretions for the purpose of studying their infectiousness. A series of these goats are to be treated with bacterial vaccine prepared from the *Micrococcus melitensis* and from time to time examinations will be made for the presence of the infective agent, both by the agglutination and complement-fixation tests, as well as by cultural and bacterioscopical examinations.

Location.—Washington, D. C., and Bethesda, Md.

Date begun.—1911.

Results.—The effectiveness of the complement-fixation and agglutination tests as diagnostic methods have been proved. Immunization procedures are promising.

Assignment.—A. Eichhorn.

Proposed expenditures, 1915–16.—$200.

Diagnosis of and Immunization against Anthrax:

Object.—To differentiate between anthrax and other diseases which bear more or less resemblance to it. This is desirable in order that owners of affected herds may take proper action in the eradication of the disease.

Procedure.—Specimen tissues removed from animals showing signs of anthrax infection are inoculated into guinea pigs. Should the inoculation prove fatal within three days, the spleen and kidneys are examined microscopically, when the presence of numerous long bacterial filaments with square or concave ends is considered diagnostic of anthrax. Should other organisms be present instead of these, the diagnosis is made accordingly and the owner advised of the proper course to pursue.

Location.—Washington, D. C.

Date begun.—1888.

Results.—In many cases of supposed anthrax the owners of the affected animals have been convinced that disease was less serious in character, and the existing ailment has been quickly eradicated.

Assignment.—A. Eichhorn, R. A. Kelser.

Proposed expenditures, 1915–16.—$1,000.

Investigation of Glanders:

Object.—To determine the various conditions which are favorable to the propagation of the disease, to establish the extent of the spread of the disease through latent cases, and to apply a method of vaccination which will protect against natural and artificial exposures to glanders.

Procedure.—Horses which are known to be free of the disease are exposed to animals which have been proved diseased with glanders by the various biological and allergic tests, but the infected animals used to transmit the disease should not show clinical evidences of glanders. Some of the horses are to be exposed in the stable and some in the open air. From time to time all animals are to be subjected to the various tests for glanders and also to clinical examinations, in order to note the effect of such exposures. Various methods will also be employed in the preparation and testing of a potent and reliable vaccine.

Location.—Washington, D. C.

Date begun.—1913.

Investigation of Glanders—Continued.

Results.—The impracticability of vaccination with dead cultures has been established and the reliability of the ophthalmic method of diagnosis proved. Publications: B. A. I. Bulletin 136, "The Diagnosis of Glanders by Complement Fixation"; Circular 191, "Various Methods for the Diagnosis of Glanders"; Department Bulletins 70, "Immunization Tests with Glanders Vaccine," and 166, "Ophthalmic Mallein for the Diagnosis of Glanders."

Assignment.—A. Eichhorn, R. A. Kelser.

Proposed expenditures, 1915–16.—$400.

Investigation of Dry Immune Serums:

Object.—To devise means by which an immune serum may be dried and prepared in powdered form without losing any of its potency and without being subjected to the dangers of contamination. The purpose of the drying is to increase the keeping quality of the serum and reduce the bulk of the injections and the cost of the product.

Procedure.—Various immune serums are dried under different conditions, such as vacuum, air current, etc., without being subjected to a temperature higher than 40° C. The dried serum is then pulverized and tested bacteriologically for contaminations and biologically for potency. Further comparative potency tests are undertaken on animals to establish the relative action of the dried serum to that of the fluid serum from which the dried form has been prepared. It is also aimed to establish by these investigations the most suitable method of keeping the powdered serum, as well as the most practical method of injecting the same.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Results thus far obtained are satisfactory but not conclusive.

Probable date of completion.—1916.

Assignment.—A. Eichhorn.

Proposed expenditures, 1915–16.—$500.

Investigation of Avian Tuberculosis, Avian Diphtheria, Bird Pox, Fowl Cholera, White Diarrhea of Fowls, and Canker of Pigeons:

Object.—The above-mentioned diseases of fowls cause serious annual losses to the poultrymen of this country. The causes and characters of these infections are not fully understood, and the work of this project is to discover the causes and devise satisfactory measures of treatment.

Procedure.—Diseased birds, both living and dead, will be examined. Cultures will be made from them for the purpose of deriving diagnostic agents and curative serums or bacterins. Medicinal agents for the cure of these various maladies will also be tested.

Location.—Washington, D. C.

Date begun.—1907.

Results.—Avian tuberculosis has been proved to be transmissible to swine through the ingestion of tuberculous fowls. Encouraging effects have been obtained by the use of vaccines for the treatment and prevention of avian diphtheria.

Assignment.—A. R. Ward, B. A. Gallagher.

Proposed expenditures, 1915–16.—$900.

Investigation of Infectious Enterohepatitis, or Blackhead, of Turkeys:

Object.—Blackhead is recognized as the great scourge to the turkey industry in America, causing immense losses yearly. No treatment has been found effective in lessening the mortality of affected birds. It is the object of this investigation to experiment with substances which have more or less specific action on protozoan organisms.

Procedure.—Affected turkeys are to be secured and subjected to a course of treatment with such substances as appear of value for this particular disease. Some birds will receive the preparation by way of the mouth, others by hypodermic injection either subcutaneously, intra-abdominally, or intravenously. Treatment will be instituted during different stages of the disease from the earliest appearance of symptoms to the stage preceding death.

Location.—Washington, D. C.

Date begun.—1911.

Results.—Carcasses received for autopsy have given opportunity for study of the causative agent.

Investigation of Infectious Enterohepatitis, or Blackhead, of Turkeys—Con.

Probable date of completion.—1918.

Assignment.—B. A. Gallagher.

Proposed expenditures, 1915–16.—$500.

Investigation of Johne's Disease, or Bacillary Enteritis, with Special Reference to Methods of Diagnosis:

Object.—To devise some reliable method of detecting the presence of Johne's disease in herds of cattle and remedies for its successful treatment.

Procedure.—Herds that are known to be affected with Johne's disease will be treated with various cultural preparations in an endeavor to find reliable testing and curative materials.

Location.—Washington, D. C.

Date begun.—1910.

Results.—Injections of avian tuberculin have been tested as diagnostic agents, and various arsenical preparations have been tried as medicinal agents, but thus far without satisfactory results.

Assignment.—B. A. Gallagher.

Proposed expenditures, 1915–16.—$300.

Investigation of the Abderhalden Test for Pregnancy in Animals:

Object.—To obtain data on the practical value of the pregnancy test to the live-stock industry, with special reference to the dairy industry.

Procedure.—Record histories of the animals to be tested for pregnancy, especially date of service, etc., will be kept. After a few weeks blood will be drawn and tested for pregnancy, the test being made on the blood serum. The results of the laboratory tests will be compared with the actual findings when the calves are dropped. An attempt will be made to verify the claim that the tests can be made on animals long before physical diagnosis of pregnancy can be made.

Location.—Washington, D. C.

Date begun.—1914.

Results.—About 250 tests were made on samples of serum obtained from a large number of cows and bulls for the purpose of acquiring the difficult technique involved in the diagnosis of pregnancy by this method. The results obtained were not uniformly correct, and further work will be necessary before reliable results can be obtained.

Assignment.—W. N. Berg.

Proposed expenditures, 1915–16.—$250.

Miscellaneous Biological Experiments:

Object.—To make miscellaneous analyses, examinations, etc., of the stomach contents of animals supposed to have died of some poison, or alleged poisonous plants, etc. These materials come to the laboratory at irregular intervals.

Procedure.—The procedure followed depends upon the nature of the material submitted and upon the information desired. Usually the information desired is whether a particular poison is present or not. This may be ascertained by examining the material submitted for the poison or by feeding the material to animals and noting the effects, if any.

Location.—Washington, D. C.

Date begun.—1912.

Results.—A total of about 25 miscellaneous examinations have been made, consisting chiefly of tests for the presence of arsenic, lead, and other poisonous metals in tissues of animals suspected of having been poisoned. In some wild ducks from Utah that had died from causes of unknown nature poisonous metals were not found. Arsenic was found to have caused death in two animals and hydrocyanic acid was found in a third.

Assignment.—W. N. Berg.

Proposed expenditures, 1915–16.—$500.

Investigations of Trichinosis and Measles, and Other Zoological Investigations Relating to Meat Inspection:

Object.—To improve methods of meat inspection in so far as parasitic diseases of food animals are concerned.

Procedure.—Parasitic conditions found in the course of meat inspection are investigated. Problems relating to specific parasites are studied with reference to their bearing on meat inspection. These studies are continued from year to year, different problems being taken up in turn.

Investigations of Trichinosis and Measles, and Other Zoological Investigations Relating to Meat Inspection—Continued.

Special investigations of trichinosis and of measles in reindeer will be continued.

Location.—Washington, D. C., and various meat-inspection stations.

Date begun.—1884.

Results.—Further data have been obtained on the effects of freezing and curing processes on the vitality of trichinæ, which will enable the trichina problem to be handled more satisfactorily in establishments under Federal meat inspection. The tapeworm cysts in the meat of Alaskan reindeer have been found to be intermediate stages of a species of dog tapeworm and evidently of the same species as the tapeworm cysts found in reindeer in Europe.

Assignment.—B. H. Ransom.

Proposed expenditures, 1915–16.—$3,000.

Index Catalogue and Collection of Parasites:

Object.—Maintenance of a comprehensive card index to the literature of animal parasites and a collection of specimens of parasites for study and reference.

Procedure.—Specimens of parasites are collected by bureau employees and by correspondents of the bureau in all parts of the world.

Cooperation.—Public Health Service, in maintenance of catalogue; National Museum, in maintenance of the collection of parasites.

Location.—Washington, D. C.

Date begun.—1890.

Results.—The literature of the entire world is rendered readily available by the index catalogue which has been partially published in cooperation with the Public Health Service. The collection of parasites is one of the largest in existence and is of great value to the work of the Zoological Division.

Assignment.—B. H. Ransom, A. Hassall.

Proposed expenditures, 1915–16.—$3,000.

Investigation of Roundworms of Sheep:

Object.—To obtain information relating to these parasites and to develop methods for their control and eradication.

Procedure.—The parasites are studied in the laboratory and in the field. A flock of sheep has been placed upon a farm near Vienna, Va., leased for the purpose, and a study will be made of the problem of controlling stomach worms and other parasites of sheep under farm conditions.

Location.—Washington, D. C., and Vienna, Va.

Date begun.—1906; experiments at Vienna, 1914.

Results.—During the past year the farm near Vienna, Va., has been fitted up with the necessary facilities for experiments in preventing and controlling the infestation of sheep with stomach worms and other parasites, and these experiments are already under way.

Probable date of completion.—Farm experiments at Vienna will probably be completed about 1921.

Assignment.—B. H. Ransom, Cooper Curtice.

Proposed expenditures, 1915–16.—$10,000.

Investigation of Parasites of Hogs:

Object.—To determine methods for the control and eradication of parasites of hogs.

Location.—Washington, D. C.

Date begun.—1887.

Results.—The development of a successful method of treatment for intestinal roundworms, using oil of chenopodium, is the most important result obtained during the past year.

Assignment.—W. D. Foster.

Proposed expenditures, 1915–16.—$2,000.

Investigation of Parasitic Protozoa:

Object.—To collect information relating to these parasites, which may be useful in their eradication and control.

Procedure.—Laboratory studies are made of various parasitic protozoa. A series of experiments has been begun to determine the mode of transfer of the Sarcosporidia from host to host and their complete life history.

Investigation of Parasitic Protozoa—Continued.

Location.—Washington, D. C.

Date begun.—1908.

Results.—Extension of studies on the early stages of the life history of the Sarcosporidia; preparation of a bulletin on the general subject of Sarcosporidiosis; addition of numerous specimens of parasitic protozoa to the study collection.

Assignment.—H. Crawley.

Proposed expenditures, 1915–16.—$2,000.

Investigations of the Use of Dips in the Treatment of Cattle Ticks, Mange Mites, and Other External Parasites:

Object.—To discover the most effective methods for the eradication and control of external parasites.

Procedure.—Various remedies and methods of treatment are tested to determine their efficacy in controlling and eradicating external parasites. So far as possible, bureau inspectors located in the districts in which experiments are undertaken are utilized in carrying out the experiments under the direction of the leader.

Cooperation.—Bureau of Entomology, where life-history studies of the parasites (insects, ticks, etc.) are made.

Location.—Headquarters at Washington, D. C., will probably be moved to Kansas City, Mo. Experiments are conducted at various temporary locations in the field.

Date begun.—1908.

Results.—The work the past year has been interfered with by the foot-and-mouth disease outbreak. Important data have been collected with reference to the effect of unoxidized and oxidized arsenical dips of various strengths on cattle, and further data have been obtained relative to their effect upon ticks. A series of experiments on the treatment of sheep for ticks has been completed.

Assignment.—Marion Imes.

Proposed expenditures, 1915–16.—$7,000.

Miscellaneous Investigations of Animal Parasites, Their Control and Eradication:

Object.—To collect information relative to animal parasites and develop methods for their control and eradication. Under this head are grouped investigations not yet sufficiently developed to justify the establishment of separate projects.

Procedure.—Laboratory and field studies are under way. New investigations are taken up from time to time and old investigations temporarily suspended are resumed as circumstances demand or opportunity offers. During the present year a study of the life history of the tapeworms of rabbits will be continued. It is expected that this study will throw light on the life history of the tapeworms of sheep, investigations of which as a separate project have been temporarily suspended. An investigation of the strongyles of horses is also planned.

Date begun.—1887.

Results.—Life-history studies on the gullet worm of sheep and cattle have been completed during the past year. Progress has been made in various other investigations not yet completed.

Assignment.—B. H. Ransom, M. C. Hall, W. D. Foster.

Proposed expenditures, 1915–16.—$6.000.

Investigation of Animal Tuberculosis:

Object.—To gain further information about the causes responsible for the dissemination of tubercle bacilli and the propagation of tuberculosis among cattle, hogs, and other domestic animals; to determine what the results are from single exposure and from long-continued and uninterrupted exposure; to determine whether tubercle bacilli are commonly or at any time sufficiently numerous in the circulating blood of tuberculous animals to make them a factor requiring special consideration relative to the use of products from such animals as food; to prove whether it is possible to keep tuberculous and healthy cattle on small areas without the transmission of the disease; to find some method for the treatment of tuberculosis; to test the reliability of commercial tuberculin; to determine the frequency with which butter is infected with tubercle bacilli; to develop a simple, safe, and economic

Investigation of Animal Tuberculosis—Continued.

method for disinfecting stables and pens which have been occupied by tuberculous animals; and to discover the most economical means for the eradication of bovine tuberculosis and the gradual conversion of a tuberculous into a healthy herd of cattle.

Location.—Bureau experiment station, Bethesda, Md.

Date begun.—About 1884.

Results.—It has been found that some species of animals are capable of harboring tubercle bacilli in their tissues for long periods of time without developing lesions of tuberculosis; that feces from tuberculous cattle are the most dangerous tuberculous material to which hogs are exposed under natural conditions, and that tuberculosis among brood sows does not seem to be a serious menace to their progeny if other exposure to infection is eliminated; that tubercle bacilli occur in the circulating blood of animals affected with advanced more or less generalized tuberculosis but not in the blood of tuberculous animals which have retained the appearance of health; that very little separation and relatively simple and inexpensive precautions are required to prevent the transmission of tuberculosis from affected to healthy herds; that all methods of treatment so far tested have proved unsatisfactory; that, though there is some variation in the strength of different brands of tuberculin, samples which fall below a reasonable standard of potency are very rare; that butter from time to time contains virulent tubercle bacilli, and much more frequently acid-fast germs microscopically like tubercle bacilli which are incapable of causing tuberculosis in test animals; that thorough cleansing of stables infected with tuberculosis followed by a coat of whitewash is all that is required to make them safe for healthy animals; and that very few calves born in a tuberculous environment contract tuberculosis if left in such an environment until they are weaned.

Assignment—E. C. Schroeder, W. E. Cotton, George W. Brett.

Proposed expenditures, 1915–16.—$5,450.

General Maintenance of Bethesda Experiment Station:

Object.—This represents overhead charges incidental to the maintenance and upkeep of the buildings, fences, and equipment at the bureau experiment station at Bethesda, Md., together with the cost of planting and harvesting crops and other operations in connection with running the farm, which items can not be segregated and charged against specific investigational projects.

Location.—Bethesda, Md.

Date begun.—1897.

Assignment.—E. C. Schroeder.

Proposed expenditures, 1915–16.—$16,250.

Breeding and Feeding Small Experiment Animals for Disease Research:

Object.—To breed and have available an abundant supply of small experiment animals of definite known history for the various investigations conducted by the several laboratories of the Bureau of Animal Industry.

Procedure.—Animals bred under conditions to secure the highest productivity and greatest freedom from disease and weakness.

Location.—Bethesda, Md.

Date begun.—1889.

Results.—It has been proved repeatedly that the small experiment animals bred at the station cost less and are more valuable from every point of view than those which can be purchased.

Assignment.—E. C. Schroeder, George W. Brett.

Proposed expenditures 1915–16.—$5,000.

Miscellaneous Animal-Disease Investigations:

Object.—This represents numerous independent minor investigations conducted at the Bethesda experiment station as required from time to time.

Location.—Bethesda, Md.

Date begun.—1897.

Results.—During the fiscal year 1914 this work has covered experiments in the study of germicides, Texas fever, and feeding tests with raw, pasteurized, boiled, and sterilized milk.

Assignment.—E. C. Schroeder.

Proposed expenditures, 1915–16.—Nominal; cost included under other projects.

Mounting Pathological Specimens for Exhibition Purposes:

Object.—To preserve and so display pathological conditions found in meat-inspection work that they may be used for general educational purposes.

Procedure.—The specimens are preserved in Kaiserling's fluid, then placed in clean watch glasses, covered with preserving fluid, and have squares of plate glass firmly fixed over them in such manner as to exhibit the abnormality present in the specimen to the best advantage.

Location.—Chicago, Ill.

Date begun.—1912.

Results.—These specimens are exhibited at all of the leading expositions and medical conventions held in this country.

Assignment.—L. E. Day

Proposed expenditures, 1915–16.—$400.

Total, Investigations of Animal Diseases, $108,450.

[Research.]

POISONOUS-PLANT INVESTIGATIONS.

Investigations of Stock Poisoning by Plants:

Object.—To study and report on losses of stock from poisonous plants, and to develop methods of avoiding losses.

Procedure.—Feeding experiments are carried on with plants that are suspected of possessing poisonous properties and the effects of their ingestion carefully noted. Sheep are used in these tests.

Cooperation.—Forest Service and Bureau of Plant Industry.

Location.—Washington, D. C., and grazing districts of the West.

Date begun.—1904.

Results.—The presence of poisonous principles in various plants has been determined and methods of obviating losses from their ingestion shown.

Assignment.—C. D. Marsh, Hadleigh Marsh, A. B. Clawson, W. N. Berg, W. W. Eggleston.

Proposed expenditures, 1915–16.—$10,000.

INVESTIGATION, TREATMENT, AND ERADICATION OF HOG CHOLERA.

Supervision:

Object.—To coordinate all work connected with hog-cholera investigation, treatment, and eradication.

Location.—Washington, D. C.

Date begun.—1913.

Assignment.—M. Dorset.

Proposed expenditures, 1915–16.—$10,000 (research, $8,750; extension, $1,250).

[Research.]

County Hog-Cholera Investigations:

Object.—To determine the most effective methods of controlling hog cholera in selected areas (counties).

Procedure.—One or more inspectors are placed in a selected area in a State, and with the cooperation of State authorities the methods of dissemination of hog cholera are studied and various means of combating the disease applied.

Cooperation.—Appropriate officials in the States in which such work is conducted.

Location.—Adel, Iowa; Crawfordsville, Ind.; Beatrice, Nebr.; Sedalia, Mo.; Marysville, Kans.; Coldwater, Mich.; Columbia, Tenn.; Olivia, Minn.; Twin Falls, Idaho; Henderson, Ky.; Bainbridge, Ga.; Mitchell, S. Dak.; Muskogee, Okla.; Danville, Ind.

Date begun.—1913.

Results.—Much information has been secured and successful results are anticipated.

Assignment.—M. Dorset, O. B. Hess.

Proposed expenditures, 1915–16.—$125,000.

Investigation of Methods of Producing Hog-Cholera Serum:

Object.—To improve and cheapen present methods of hog-cholera serum production.

Procedure.—Investigations will be made of a variety of methods of treating hogs for the production of serum and the methods of treating the serums secured by such new processes or by old processes, so as to render the serum more potent and of a better quality. Investigations will also be made of methods of testing serums. These studies will be made in the laboratory, and tests will be made on hogs when required.

Location.—Washington, D. C.; Ames, Iowa; and Bethesda, Md.

Date begun.—1908.

Assignment.—M. Dorset.

Proposed expenditures, 1915–16.—$6,000.

Preparation of Hog-Cholera Serum:

Object.—To produce hog-cholera serum to meet the requirements of the experiments carried out under the hog-cholera county control investigations.

Location.—Ames, Iowa.

Date begun.—1913.

Results.—In 1914 sufficient serum was prepared to treat approximately 200,000 hogs.

Assignment.—W. B. Niles.

Proposed expenditures, 1915–16.—$53,000.

[Extension.]

Demonstrational and Educational Hog-Cholera Work:

Object.—To demonstrate to farmers the means by which they may, by their own efforts, reduce losses from hog cholera.

Procedure.—Trained inspectors are sent, one to each selected State, to explain the nature of hog cholera and the best methods of prevention.

Cooperation.—States Relations Service and agricultural colleges, or other State institutions in the State in which the work is conducted.

Location.—Virginia, North Carolina, Georgia, Florida, Alabama, Oklahoma, Texas, Arkansas, and California.

Date begun.—1914.

Results.—Numerous addresses made and organizations begun to control hog cholera.

Assignment.—M. Dorset, U. G. Houck.

Proposed expenditures, 1915–16.—$24,000.

Total, Investigation, Treatment, and Eradication of Hog Cholera, $218,000 (research, $192,750; extension, $25,250).

ERADICATION AND CONTROL OF ANIMAL DISEASES.

Supervision:

Object.—To supervise all work connected with the eradication and control of animal diseases and prevent the interstate spread of the contagion of these diseases; to perform duties connected with the general work of eradication, including correspondence with the public and conferences with other branches of the Government service.

Location.—Washington, D. C.

Date begun.—1884.

Assignment.—M. Dorset, J. R. Mohler, R. W. Hickman, R. A. Ramsay.

Proposed expenditures, 1915–16.—$9,000 (research, $75; regulation, $8,825; extension, $100).

[Regulation.]

Supervision of Interstate Transportation of Live Stock:

Object.—To make a careful examination and inspection of all live stock unloaded at market centers and public stockyards where Federal inspection is maintained, to determine the presence in any of the animals of communicable diseases which might be transmitted to animals in other States; also, to issue certificates covering interstate movement of animals free from disease or which have been treated under bureau supervision.

Cooperation.—Live-stock sanitary officials of the various States.

Supervision of Interstate Transportation of Live Stock—Continued.

Location.—Sixty-four cities, more or less, at various points throughout the United States.

Date begun.—1884.

Results.—During the fiscal year 1914 31,685,757 sheep were inspected and 1,788,475 dipped; 13,695,026 cattle were inspected and 104,795 dipped; 32,158 cars were cleaned and disinfected.

Assignment.—R. A. Ramsay, W. P. Ellenberger.

Proposed expenditures, 1915–16.—$132,000.

Eradication of Scabies in Sheep:

Object.—To cooperate with States in which scabies in sheep exists by providing quarantine measures to prevent its spread and by demonstrating proper treatment, including the cleaning and disinfection of cars, pens, and other premises, thereby fostering the industry and encouraging greater production of mutton and wool.

Procedure.—Inspection of animals in the areas where scabies exists and dipping of diseased or exposed animals under State or Federal supervision.

Cooperation.—Live-stock sanitary boards and other organizations in Arizona, California, Tennessee, Nevada, New Mexico, Texas, Utah, Idaho, Kansas, Kentucky, Missouri, and Oregon.

Location.—States mentioned under "Cooperation."

Date begun.—1903.

Results.—Territory released from quarantine for scabies in sheep, 1,416,526 square miles, leaving 368,070 square miles still under Federal quarantine for this purpose. During the fiscal year 1914 there were 20,639,428 sheep inspected and 7,517,578 dipped for scabies.

Probable date of completion.—1918.

Assignment.—R. A. Ramsay, W. P. Ellenberger.

Proposed expenditures, 1915–16.—$177,000.

Eradication of Mange (Scabies) in Cattle and Horses:

Object.—To eradicate scabies in cattle and horses by providing quarantine measures to prevent its spread and by demonstrating proper treatment, including the cleaning and disinfection of cars, pens, and other premises, thereby fostering the horse industry and increasing the production of beef and dairy products.

Procedure.—Inspection of animals in the areas where scabies exists and dipping diseased or exposed animals under State or Federal supervision.

Cooperation.—Live-stock sanitary boards and other organizations in Idaho, Montana, Nebraska, Texas, Wyoming, New Mexico, Oklahoma, Kansas, Missouri, Oregon, and South Dakota.

Location.—States mentioned under "Cooperation."

Date begun.—1905.

Results.—Territory released from quarantine for cattle scabies, 1,249,850 square miles, leaving 19,994 square miles still under quarantine for this purpose. No territory has been quarantined specifically against scabies in horses, as the eradication of this disease has been conducted in conjunction with the eradication of cattle scabies. During the fiscal year 1914 there were 2,812,632 cattle inspected and 1,807,950 cattle dipped.

Assignment.—R. A. Ramsay, W. P. Ellenberger.

Proposed expenditures, 1915–16.—$120,225.

Inspection and Tuberculin Testing of Cattle and Mallein Testing of Horses for Interstate Movement:

Object.—To prevent the spread of tuberculosis of cattle and of glanders in horses and mules.

Procedure.—On request of transportation company or shipper at the stockyards of a station where bureau inspection is maintained in other classes of work, veterinarians are detailed to inspect and test cattle with tuberculin, and horses, mules, and asses with mallein, and, if found free from disease, issue interstate certificates therefor in compliance with the laws of the State to which destined. Animals found to be diseased with tuberculosis or glanders are required to be disposed of in accordance with the laws of the State in which the disease is discovered.

Cooperation.—Work conducted in accordance with the laws and regulations of the State to which interstate shipments of animals are destined.

Inspection and Turberculin Testing of Cattle and Mallein Testing of Horses for Interstate Movement—Continued.

Location.—Forty-seven cities, more or less, throughout the United States at which veterinary inspectors are stationed.

Date begun.—1910.

Results.—During the fiscal year 1914 there were 142,904 cattle inspected, of which 25.389 were tested with tuberculin; 49,748 horses and mules inspected, of which 10.016 were tested with mallein.

Assignment.—R. A. Ramsay, W. P. Ellenberger.

Proposed expenditures, 1915–16.—$35,500.

Investigating Alleged Violations of Live-Stock Quarantine Regulations:

Object.—To obtain, for the use of the Department of Justice, specific information relating to interstate movement of live stock from areas under quarantine for contagious diseases in violation of department regulations.

Procedure.—Bureau employees stationed at market or stockyard centers or feeding points en route are required to examine waybills issued by transportation companies for the purpose of ascertaining whether the shipment of live stock covered thereby is from an area under Federal quarantine for contagious diseases, or whether it is accompanied by a certificate of inspection or treatment issued by an inspector of this bureau permitting such interstate movement from the area under quarantine.

Location.—Washington, D. C., and 64 cities, more or less, in various sections of the United States.

Date begun.—1884.

Results.—During the fiscal year 1914 there were submitted to the Solicitor of the department 230 reports (involving 254 cases reported for prosecution) of alleged violations of the quarantine laws and regulations. The fines imposed in the cases decided in favor of the Government, including costs, amounted to $9.521 21.

Assignment.—R. A. Ramsay, W. P. Ellenberger.

Proposed expenditures, 1915–16.—$2,000.

Supervision of the Inoculation of Swine Against Hog Cholera for Interstate Movement from Public Stockyards:

Object.—To provide for the interstate movement of swine from public stockyards for purposes other than immediate slaughter, if they have been properly immunized against hog cholera.

Procedure.—To detail bureau veterinarians to public stockyards to make a careful inspection of swine, and, if found free from symptoms of cholera or other contagious or communicable diseases, to supervise their immunization against cholera at the expense and risk of the owner by either the "serum alone" method or the "simultaneous inoculation" method, as may be decided upon by the owner; to supervise the disinfection after either treatment above mentioned and to see that the animals are loaded into properly cleaned and disinfected cars for interstate movement.

Cooperation.—Work conducted in accordance with the laws and regulations of the States to which interstate shipments of swine are destined.

Location.—Twenty-two cities, more or less, throughout the United States.

Date begun.—1914.

Results.—During the first 10 months of the fiscal year 1914 there were 20.717 swine immunized against hog cholera for interstate movement from public stockyards for purposes other than immediate slaughter.

Assignment.—R. A. Ramsay, W. P. Ellenberger.

Proposed expenditures, 1915–16.—$10,000.

Eradication of Tuberculosis Among Dairy Herds:

Object.—To suppress and prevent the spread of tuberculosis in dairy herds of cattle, and to provide milk supplies from cattle free from tuberculosis.

Procedure.—The presence of tuberculosis is determined by the application of the subcutaneous tuberculin test, applied upon request of State and municipal authorities, the Office of Indian Affairs, Department of the Interior, and in accordance with individual agreements signed by cattle owners.

Cooperation.—State and municipal authorities in the localities where the work is conducted, cattle owners, and the Office of Indian Affairs, Department of the Interior.

Location.—District of Columbia, Virginia, Maryland, and various Indian reservations.

Eradication of Tuberculosis Among Dairy Herds—Continued.

Date begun.—1907.

Results.—During the first 10 months of the fiscal year 1915 there were 6.160 cattle tested, of which 5.507 were free from tuberculosis and 653 reacted, indicating that 10.6 per cent of the cattle tested were tuberculous. This represents approximately four months of work accomplished prior to the 1915 outbreak of foot-and mouth disease.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$20,000.

Eradication of Dourine:

Object.—Eradication of this disease in order to prevent spread of same and encourage the breeding of horses.

Procedure.—Inspection of all horses in areas where the disease is known to exist and removal of stallions in such areas from the open range; the securing of blood serum from each animal, forwarding serum to the bureau laboratory at Washington for examination by the complement-fixation method; slaughter of all mares reacting to the test and slaughter or castration of all reacting stallions.

Cooperation.—Office of Indian Affairs, Interior Department, and various officials in the States in which the work is conducted.

Location.—Western Nebraska, western North Dakota, western South Dakota, eastern Montana, eastern Wyoming, and the Navajo Indian Reservation in Arizona and New Mexico.

Date begun.—1912.

Results.—During the first 10 months of the fiscal year 1915 there were 40.000 horses inspected and tested for dourine and 1,065 horses destroyed.

Probable date of completion.—1918.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$50.000.

Tuberculin Testing of Pure-Bred Breeding Cattle:

Object.—To suppress and prevent the spread of tuberculosis among herds of pure-bred cattle used for breeding purposes; to establish a public register of pure-bred herds which have been shown to be free from tuberculosis, in order that breeders throughout the country may have assurance of the healthfulness of pure-bred cattle which they are purchasing for the improvement of their herds.

Procedure.—The application of the subcutaneous tuberculin test following the voluntarily-signed agreements of the owners of pure-bred herds of breeding cattle.

Cooperation.—Owners of pure-bred herds of breeding cattle, State live-stock sanitary authorities, and breeding associations.

Location.—Various places throughout the United States wherever herds are located.

Date begun.—1914.

Results.—The outbreak of foot-and-mouth disease has caused active work to be postponed.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$25,000.

Manufacture and Distribution of Tuberculin:

Object.—To furnish a supply of tuberculin for the testing of animals.

Procedure.—Tuberculin is manufactured in the laboratories at Washington and furnished free of cost to Federal, State, county, and municipal officials, with the understanding that reports of the tests are to be made to the bureau, and provided also that the tuberculin furnished is to be used only for official work.

Cooperation.—No cooperation other than that reports of results of tests are obtained from the individuals to whom the tuberculin is sent.

Location.—Tuberculin manufactured at Washington, D. C., but used at various points in the field as required.

Date begun.—1892.

Results.—In the fiscal year 1914 there were 488,466 doses of tuberculin prepared and distributed.

Assignment.—J. A. Emery.

Proposed expenditures, 1915–16.—$5.500.

Manufacture and Distribution of Mallein:

Object.—To furnish a supply of mallein used for the testing of animals.

Procedure.—Same as preceding project.

Cooperation.—Same as preceding project.

Location.—Same as preceding project.

Date begun.—About 1892.

Results.—During the fiscal year 1914 there were 219,352 doses of mallein prepared and distributed.

Assignment.—J. A. Emery.

Proposed expenditures, 1915–16.—$2,750.

Control of Glanders and Scabies in Horse Stock in the District of Columbia:

Object.—To prevent the spread of and eradicate glanders and scabies of horse stock in the District of Columbia.

Procedure.—Inspection and testing of animals which have been exposed to or are suspected of being affected with these diseases; slaughter or quarantine of animals when necessary; quarantine and disinfection of premises. This procedure is repeated whenever isolated cases or outbreaks of the diseases are reported.

Cooperation.—Commissioners of the District of Columbia, principally consisting in receipt of reports from the health department of the District of Columbia and the Metropolitan police force of the District of Columbia. Reports are also received from practicing veterinarians.

Location.—Washington, D. C.

Date begun.—1887.

Results.—No outbreaks of glanders have occurred in the District during the past fiscal year. Animals badly infected with scabies have been destroyed, others successfully treated, and stables and utensils disinfected.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$300.

Control of Animal Diseases in Porto Rico and Hawaii:

Object.—Prevention of the introduction of diseases through animals imported; prevention of the dissemination of disease within the islands.

Procedure.—Import animals inspected and quarantined as required, possible outbreaks of disease investigated, and measures taken to prevent the spread of diseases and to eradicate them.

Cooperation.—Local authorities.

Location.—Washington, D. C.; San Juan, Porto Rico; no bureau representative in Hawaii at present time.

Date begun.—1907.

Results.—Importation of diseased animals and serious outbreaks of disease on the islands have been prevented.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$900.

[Extension.]

Manufacture and Distribution of Blackleg Vaccine:

Object.—To furnish a supply of blackleg vaccine to owners of animals requesting same, with a view to preventing this disease.

Procedure.—The vaccine is manufactured in the laboratories at Washington and distributed free upon request.

Location.—Washington, D. C.

Date begun.—1897.

Results.—During the fiscal year 1914, 2 373,540 doses were prepared.

Assignment.—R. A. Kelser.

Proposed expenditures, 1915–16.—$10,000.

[Research.]

Investigation and Chemical Testing of Dips and Disinfectants:

Object.—To insure the employment of properly compounded dips and disinfectants in official dipping and disinfecting operations.

Procedure.—Chemical and bacteriological studies of dips and of methods of compounding dips and disinfectants, and studies of methods for testing these substances in the field.

Cooperation.—Bureau of Chemistry.

Location.—Washington, D. C.

Investigation and Chemical Testing of Dips and Disinfectants—Continued.

Date begun.—1907.

Results.—Dipping baths have been standardized and outfits for field testing of dips have been devised.

Assignment.—R. M. Chapin.

Proposed expenditures, 1915–16.—$6,500.

Total, Eradication and Control of Animal Diseases, $606,675 (research, $6,575; regulation, $590,000; extension, $10,100).

[Regulation.]

ERADICATION OF CATTLE TICKS.

Eradication of Cattle Ticks:

Object.—The extermination of the ticks which spread the infection of splenetic fever of cattle.

Procedure.—Educational and demonstration work followed by vacating pastures for a time, or the systematic disinfection of the cattle to prevent the propagation of the ticks.

Cooperation.—State organizations and institutions in Alabama, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

Location.—States mentioned under "Cooperation."

Date begun.—1906.

Results.—Since this work was begun ticks have been exterminated from approximately 253,288 square miles of territory and this area released from Federal quarantine; 8,457,655 animals were inspected during the year ending December 31, 1914.

Probable date of completion.—1924.

Assignment.—R. A. Ramsay, W. P. Ellenberger.

Proposed expenditures, 1915–16.—$385,800.

[Extension.]

LIVE-STOCK DEMONSTRATION WORK IN AREAS FREED FROM CATTLE TICKS.

Live-Stock Demonstration Work in Tick-Freed Areas:

Object.—To demonstrate to farmers the best means within their reach to better develop the live-stock industry and dairying in the areas freed from cattle ticks in the Southern States.

Procedure.—Reorganization of tick-eradication associations and county live-stock associations into organizations for the purpose of devising ways and means of introducing better live stock into the community and to develop better pastures and forage crops in order that live stock may be properly cared for. For this purpose there are assigned to each State one or more employees experienced in animal husbandry and the dairy industry, whose duty it is to cooperate with agents in the employ of the States Relations Service and with State employees doing the same class of work. Bureau veterinarians engaged in tick eradication are instructed to cooperate with these different forces in the inspection and tuberculin testing of live stock for disease, to the end that disease may not be introduced by live stock brought into tick-freed areas.

Cooperation.—States Relations Service and individual farmers and associations in different localities in the various Southern States from which ticks have been eradicated.

Location.—Various localities which have been freed from ticks in Louisiana, Mississippi, Alabama, Georgia, South Carolina, North Carolina, Arkansas, Oklahoma, and Texas.

Date begun.—1914.

Results.—This work has only recently been started and is at the present time in process of organization, and no statement as to results can be given further than the fact that there is a great demand for this class of work by farmers in tick-free areas. Many pure-bred animals, especially sires, have been introduced, and it is believed that this will have the effect of bettering the live-stock industry in the sections concerned.

Live-Stock Demonstration Work in Tick-Freed Areas—Continued.

Assignment.—R. A. Ramsay, B. H. Rawl, G. H. Rommel, of this bureau; Bradford Knapp and employees of the States Relations Service in charge of field forces in the Southern States.

Proposed expenditures, 1915–16.—$50,000.

INSPECTION AND QUARANTINE OF IMPORTED ANIMALS.

Supervision:

Object.—Supervision of the work of inspection and quarantine of imported animals and the performance of duties common to the whole work.

Cooperation.—Treasury Department and the Department of State.

Location.—Washington, D. C.

Date begun.—1884.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$5,355 (research, $55; regulation, $5,300).

[Regulation.]

Inspection of Animals for Importation from Mexico:

Object.—To prohibit the importation of diseased animals from Mexico through inspection at ports of entry and the establishment of quarantines when necessary.

Cooperation.—Collectors of customs at ports of entry.

Location.—Ports of entry in Arizona, California, and Texas.

Date begun.—1884.

Results.—During the first 10 months of the fiscal year 1915 there were 485.625 animals inspected for entry from Mexico.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$21,000.

Inspection of Animals for Importation from Canada:

Object.—To prohibit the importation of diseased animals from Canada through inspection at ports of entry and the establishment of quarantines when necessary.

Cooperation.—Collectors of customs at ports of entry.

Location.—Ports of entry in Maine, Vermont, New York, Michigan, North Dakota, Montana, and Washington.

Date begun.—1884.

Results.—During the first 10 months of the fiscal year 1915 there were 388 021 animals inspected for entry from Canada.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$35,000.

Inspection of Animals for Importation from Other than North American Countries:

Object.—To prohibit the importation of diseased animals through inspection on vessels before landing and transfer to quarantine stations for observation.

Cooperation.—Collectors of customs at ports of entry.

Location.—Ports of entry in the States of Massachusetts, New York, Maryland, California, and Washington.

Date begun.—1884.

Results.—During the first 10 months of the fiscal year 1915 there were 2,281 animals inspected in connection with this work.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$8,000.

Inspection and Testing of Animals in Great Britain Intended for Export to the United States:

Object.—To prohibit the importation of diseased animals through inspection and tuberculin testing of cattle before shipment.

Cooperation.—American consuls in Great Britain.

Location.—Great Britain, Ireland, and the Channel Islands.

Date begun.—1900.

Results.—In the first 10 months of the fiscal year 1915 there were 444 cattle tested for exportation to the United States.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$7,000.

Quarantine of Animals at Ports of Entry:

Object.—To prohibit the importation of diseased animals.

Procedure.—Animal quarantine stations are provided by the department and equipped with buildings and facilities for detention and isolation of live stock. Ruminants and swine and collie and shepherd dogs are held under supervision, as provided by regulations, and during the period of quarantine are carefully observed and subjected to blood or other tests as deemed necessary.

Location.—Turner (Baltimore), Md.; Athenia (New York), N. J.; and Littleton (Boston), Mass.

Date begun.—1884.

Results.—During the first 10 months of the fiscal year 1915 there were 1.495 animals quarantined at these stations.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$21,000.

Supervision over Importations of Hay, Forage, Hides, Hair, Wool, and Other Animal By-Products, etc.:

Object.—To prevent the introduction of animal diseases.

Procedure.—Inspectors at ports of entry, in cooperation with customs officials, prevent the landing of prohibited feedstuffs, animal by-products, etc., and supervise disinfection as required.

Cooperation.—United States customs officials at ports of entry; American consuls at ports of shipment.

Location.—Various ports of entry where bureau inspection is maintained.

Date begun.—1890.

Results.—There have been no instances of the introduction of infection through such products over which the bureau has maintained supervision.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$500.

[Research.]

Investigation of Methods of Disinfecting Hides:

Object.—To determine the best methods for the disinfection of hides, in order to prevent the introduction of infectious material.

Procedure.—Bacteriological studies are made of the effect of disinfectants on various disease-producing microorganisms, particularly anthrax; the effect of disinfectants on such organisms when placed on hides is also studied.

Location.—Washington, D. C.

Date begun.—1912.

Results.—Effectiveness of Seymour-Jones and Schattenfroh methods determined and results published in the Journal of Agricultural Research, April 15, 1915.

Assignment.—F. W. Tilley.

Proposed expenditures, 1915–16.—$1,000.

Total, Inspection and Quarantine of Imported Animals, $98,855 (regulation, $97,800; research, $1,055).

[Regulation.]

EXPORT LIVE-STOCK INSPECTION.

Supervision:

Object.—Supervision of all work connected with export live-stock inspection. and the performance of duties common to the whole work.

Cooperation.—Governments to which animals are consigned.

Location.—Washington, D. C.

Date begun.—1891.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$1.700.

Inspection and Testing of Animals Exported to Foreign Countries:

Object.—To insure freedom of export animals from disease.

Procedure.—Animals are inspected and tested as required by countries to which exported and reinspected at ports of export and certificates issued.

Cooperation.—Canadian Government.

Inspection and Testing of Animals Exported to Foreign Countries—Contd.

Location.—Various bureau stations and other places as may be required.

Date begun.—1890.

Results.—During the first 10 months of the fiscal year 1915 there were 308,861 animals inspected for export to foreign countries.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$2,700.

Inspection of Vessels Carrying Export Animals:

Object.—To provide for the safe transportation and humane treatment of export live stock.

Procedure.—Vessels are surveyed and construction of fittings supervised to conform to department regulations; loading is supervised.

Cooperation.—Collectors of customs at ports of shipment.

Location.—Ports of export in the States of Maine, New York, Maryland, South Carolina, Louisiana, Washington, Massachusetts, Pennsylvania, Virginia, Texas, and California.

Date begun.—1891.

Results.—During the first 10 months of the fiscal year 1915 there were 103 vessels inspected in connection with this work.

Assignment.—R. W. Hickman.

Proposed expenditures, 1915–16.—$2,000.

Total, Export Live-Stock Inspection, $6,400.

[Regulation.]

ENFORCEMENT OF THE 28-HOUR LAW.

Enforcement of the 28-Hour Law:

Object.—To ascertain whether animals being shipped interstate have been unloaded for feeding, resting, and watering at such periods as are required by law; also to ascertain whether the animals have been handled in a humane manner at stockyards where such unloading is performed.

Procedure.—Bureau employees stationed at market or stockyard centers or feeding points en route are required to examine waybills issued by transportation companies for the purpose of ascertaining by notations made thereon when and at what points the animals were unloaded en route for the purpose of feed, rest, and water, and to report the facts to the bureau.

Cooperation.—Department of Justice, office of Solicitor, and various transportation companies and shippers of live stock.

Location.—United States.

Date begun.—1906.

Results.—During the fiscal year 1914 there were submitted to the Solicitor of the department 1,608 cases of alleged violation of the 28-hour law. The fines imposed in the cases decided in favor of the Government, including costs, amounted to $47,594.76.

Assignment.—R. A. Ramsay, W. P. Ellenberger.

Proposed expenditures, 1915–16.—$20,000.

[Regulation.]

CONTROL OF THE MANUFACTURE, IMPORTATION, AND SHIPMENT OF VIRUSES, SERUMS, ETC.

Control of Viruses, Serums, etc.:

Object.—To enforce the law governing the interstate shipment and the importation of viruses, serums, toxins, and analogous products intended for use in the treatment of diseases of domestic animals.

Procedure.—Inspection of establishments which manufacture for interstate business or which import viruses, serums, toxins, etc.; supervision of methods of manufacture; examination of samples; collection of evidence of violation of the law; and issuance of licenses and permits.

Cooperation.—Collectors of customs.

Location.—Washington, D. C., and various cities where licensed plants are located.

Date begun.—1913.

Control of Viruses, Serums, etc.—Continued.

Results.—During the fiscal year 1914 there were 97 licenses issued, 43 refused, 1 suspended, and 5 revoked; 3 permits were issued and 2 refused; 3 convictions for violations of the law and 20 violations under investigation; worthless or contaminated serum withheld from market, 2,812,003 cubic centimeters.

Assignment.—M. Dorset, A. R. Ward.

Proposed expenditures, 1915–16.—$105,000.

INSECTICIDE AND FUNGICIDE INVESTIGATIONS.

[Regulation.]

Insecticide Work:

Object.—To hold and report hearings in connection with the enforcement of the insecticide act.

Procedure.—Papers are forwarded to the inspector in charge in the city designated, who cites manufacturer and holds hearing, returning all necessary papers duly executed, together with a copy of the stenographic report of the hearing.

Cooperation.—Insecticide and Fungicide Board.

Location.—Washington, D. C., and cities where meat-inspection establishments under Government inspection are located.

Date begun.—1910.

Results.—Thirty-five hearings have been held during the fiscal year 1914.

Assignment.—J. A. Emery.

Proposed expenditures, 1915–16.—$1,500.

Routine Examination of Official Samples:

Object.—Enforcement of the insecticide act of 1910 as related to combating animal diseases.

Procedure.—Official samples of insecticides and fungicides are subjected to bacteriological and chemical inspection, and tests of efficacy are made when necessary.

Cooperation.—Insecticide and Fungicide Board.

Location.—Washington, D. C.

Date begun.—1910.

Results.—Samples representing 180 cases were examined, of which 150 have been reported to the Insecticide and Fungicide Board, with recommendation for subsequent action, the remainder being held for further consideration.

Assignment.—J. A. Emery.

Proposed expenditures, 1915–16.—$2,750.

[Research.]

Investigation of Various Ingredients Used in Insecticides and Fungicides:

Object.—To secure information regarding the effectiveness of such ingredients and their physiological effects on animals, thus promoting intelligent and effective enforcement of the law.

Procedure.—Chemical and bacteriological investigations, and tests on animals when required.

Cooperation.—Insecticide and Fungicide Board.

Location.—Washington, D. C.

Date begun.—1910.

Results.—Methods for the examination of certain unusual preparations have been established and the parasiticidal value of certain other preparations determined.

Assignment.—J. A. Emery.

Proposed expenditures, 1915–16.—$250.

Toxicity of Disinfectants:

Object.—To determine whether a disinfectant is toxic or nontoxic; determine the lethal dose; describe the pathological changes produced by the disinfectants on various tissues; and establish whether the lesions produced are temporary or permanent in character.

Procedure.—The animal is observed for several days prior to the administration of the disinfectant, and the amount of food consumed is weighed

Toxicity of Disinfectants—Continued.

and the amount of water measured daily. Excrement is weighed daily and urine measured and examined for albumin. The disinfectant is administered by means of the stomach tube. Observation and recording of the symptoms produced by the substance are made to ascertain whether the substance is toxic or nontoxic. The symptoms produced by the disinfectant in question with the symptoms of other coal-tar products are compared to determine similarity (or dissimilarily) in action. The least fatal or lethal dose will be established. The effect of different dilutions, i. e., 1:1, 1:2, 1:3, 1:4, and 1:5, will be noted. Post-mortem examinations to determine the pathological changes produced by the disinfectants on various tissues and organs will be made, including the digestive tract, the respiratory system, the eliminating glands, and other internal organs. Microscopic examinations of the various organs will be made to ascertain the presence or absence of the minute structural changes requiring fixation, preservation, dehydration, embedding, cutting, securing to the slide and removing the paraffin, staining, and mounting.

Cooperation.—Insecticide and Fungicide Board.

Location.—Washington, D. C.

Date begun.—1913.

Results.—The poisonous and corrosive action of certain coal-tar preparations when internally administered has been established.

Assignment.—R. J. Formad.

Proposed expenditures, 1915–16.—$350.

Total, Insecticide and Fungicide Investigations, $4,850 (research, $600; regulation, $4,250).

BUREAU OF PLANT INDUSTRY.

GENERAL ADMINISTRATION.

Office of Chief:

Object.—The effective administration of the affairs of the Bureau of Plant Industry and general direction of all of its investigational activities.

Cooperation.—Other offices of the department, other departments, and State experiment stations.

Location.—Washington, D. C.

Date begun.—1900.

Assignment.—William A. Taylor, chief; K. F. Kellerman, assistant chief.

Proposed expenditures, 1915–16.—$33,810.

Office of Chief Clerk:

Object.—General supervision of the clerical force and janitor service of bureau, purchase of supplies and equipment, handling mail, operation and maintenance of central file room and property room, and all matters pertaining to appointments, pay rolls, and leaves of absence.

Cooperation.—Other offices of the department and other departments.

Location.—Washington, D. C.

Date begun.—1900.

Assignment.—James E. Jones.

Proposed expenditures, 1915–16.—$38,130.

Editorial Work:

Object.—To edit and prepare for printing manuscripts and to read and revise proofs of articles submitted for publication by investigators of the bureau; also similar work in connection with all printing required by the bureau.

Cooperation.—Other bureaus of the department and the Division of Publications.

Location.—Washington, D. C.

Date begun.—1902.

Assignment.—J. E. Rockwell.

Proposed expenditures, 1915–16.—$7,870.

Accounts:

Object.—The systematic administration of the fiscal affairs of the bureau.

Cooperation.—Disbursing office of the department; the Treasury Department.

Location.—Washington, D. C.

Date begun.—1905.

Assignment.—W. P. Cox.

Proposed expenditures, 1915–16.—$23,130.

Library:

Object.—To maintain a working reference collection of the department books on botany; to furnish to the bureau scientists specialized bibliographical assistance in the use of the library resources of the department and of those of other libraries in and outside Washington; to do other work for the bureau for which a knowledge of the department library methods and botanical bibliography is essential.

Procedure.—Records of books in use are kept in accordance with the system employed by the department library; current periodicals are circulated regularly, with a follow-up system to insure prompt service. Current phytopathological literature is indexed, and reference and bibliographical work is done as needs develop, also some translating and abstracting. References appearing in bureau publications and in the Journal of Agricultural Research are edited according to approved rules. A central mailing list, domestic and foreign, is maintained (the foreign

Library—Continued.

list being an exchange list). Records are kept of books purchased on bureau funds for field stations.

Cooperation.—Department library, Library of Congress, and other libraries in and outside of Washington; Division of Publications.

Location.—Washington, D. C.

Date begun.—1900.

Assignment.—Eunice R. Oberly.

Proposed expenditures, 1915–16.—$8,040.

Total, General Administration, $110,980 (research, $97,980; extension, $12,800; regulation, $200).

[Research.]

LABORATORY OF PLANT PATHOLOGY.

GENERAL LABORATORY INVESTIGATIONS.

General Laboratory Investigations:

Object.—To ascertain the life history of fungi and bacteria parasitic on agricultural plants, with a view to discovering means of prevention and remedies for various diseases.

Procedure.—The work involves microscopic examination of diseased material in fresh condition and also when embedded in paraffin and stained; isolation of organisms from the diseased tissues and study of their life histories on various culture media; inoculation experiments in the hothouses and elsewhere; testing various fungicides, germicides, etc.; field study when the cases are serious enough to warrant it.

Cooperation.—Usually entirely within the department; occasionally cooperative experiments are undertaken in certain localities.

Location.—Washington, D. C., and at any point in the field when conditions demand personal attention.

Date begun.—1901.

Results.—Many plant diseases have been studied, carefully worked out, and reported upon, e. g., crown-gall, wilt of cucurbits, black-rot of cabbage, watermelon wilt and other wilt diseases due to Fusarium, tomato blight, tobacco blight, potato blight, hyacinth disease, sugar-cane diseases, bean blight and spot diseases, angular leaf-spot of cotton, Stewart's disease of sweet corn, black-spot of plum, dry-rot of potatoes, bud-rot of the coconut palm, citrus-knot disease, broom-corn diseases, etc. The results obtained enable the department and the farmer to act intelligently in applying remedies and preventives for the various diseases studied, some of which are of great economic importance. (In this connection see the publications from this laboratory.)

Assignment.—Erwin F. Smith.

Proposed expenditures, 1915–16.—$22,864.

SPECIAL INVESTIGATIONS.

Diseases of Pond Lilies:

Object.—To establish the causes and work out life histories and the control of diseases of pond lilies.

Procedure.—The investigations will comprise cultural studies of the causal organisms and inoculation experiments in greenhouse, laboratory, and field to establish causal relations and life histories; possibly also continuation of control spraying experiments which have already given promise of results.

Location.—The principal part of the investigation of this project will be carried out in the District of Columbia, but collecting and observation trips may be necessary through New York, New Jersey, etc. Field work also may be necessary in the neighborhood of Greenport (Long Island), N. Y.

Date begun.—1913.

Results.—No cultural or inoculation work has been found on record concerning any of the parasitic diseases of pond lilies. Several years ago a series of spray tests was conducted by the New Jersey Experiment Station against a leaf disease apparently due to a Cercospora, but no

Diseases of Pond Lilies—Continued.

cultural studies or inoculation work were recorded. Spraying experiments, cultural studies, and inoculation work were begun by the leader of this project during the summer of 1913 on a Helicoosporium leaf disease doing considerable damage at the aquatic gardens of Mr. W. B. Shaw, Kenilworth, D. C. The work upon this serious disease is now nearly completed and ready for publication. Study is also now being made of several other fungous diseases of pond lilies, of a rather serious fungous leaf-spot of lotus, and of a leaf-rot of water lettuce.

Probable date of completion.—January, 1917.

Assignment.—Frederick V. Rand.

Proposed expenditures, 1915–16.—$1,260.

Control of Bacterial Wilt of Tobacco:

Object.—To determine means of preventing and eradicating the bacterial wilt disease of tobacco.

Procedure.—An attempt will be made, on the one hand, to take advantage of certain weaknesses of the parasite which have been discovered; and, on the other hand, of the fact that certain methods of soil management appear to render tobacco particularly susceptible to wilt. New methods of cultivation and of soil treatment that appear likely to weaken the parasite and to strengthen the host are being tried. The field work will be checked up by similar experiments in laboratory and greenhouse, where more exact control of conditions is possible, so as to determine the basic principles involved in the control of the disease.

Cooperation.—Laboratory and greenhouse experiments are conducted without cooperation. The field experiments are conducted in cooperation with the American Sumatra Tobacco Co.

Location.—Laboratory and greenhouse work in Washington, D. C.; field experiments in Gadsden County, Fla., and later possibly at other points in Florida, as well as in Georgia.

Date begun.—1912.

Results.—Field work was only started in October, 1914, but the results of this work are not yet evident.

Probable date of completion.—1918.

Assignment.—R. E. B. McKenney.

Proposed expenditures, 1915–16.—$3,700.

Alternaria Leaf Disease of Cucurbits:

Object.—To complete the life-history work on the causal organism (*Alternaria brassicae* var. *nigrescens* Peglion) and to devise methods of control for the disease.

Procedure.—The investigation will comprise cultural studies of the causal organism and inoculation experiments to further work out the life history and biological relations of the organism.

Location.—Laboratory and greenhouse experiments on this project to be carried out in Washington, D. C.; field observations and experiments to be carried out in the neighborhood of Greenport (Long Island), N. Y., for the season of 1915; in addition, observation trips may be necessary through Maryland, Delaware, New Jersey, Michigan, Wisconsin, Indiana, and Iowa.

Date begun.—1892.

Results.—Successful cultural studies and inoculations have been carried out, but the work is not fully completed. Under this project considerable cultural and inoculation work has already been done and field observations made since August, 1914.

Probable date of completion.—January, 1918.

Assignment.—Erwin F. Smith.

Proposed expenditures, 1915–16.—$2,226.

Bacterial Wilt of Cucurbits:

Object.—To further investigate the biological and soil relations of the causal organism (*Bacillus tracheiphilus* Erwin F. Sm.), to devise methods of control for the disease, and to further ascertain its distribution.

Procedure.—The investigation will comprise cultural studies of the causal organism, and inoculation experiments in greenhouse and field relative to further working out the biological relations of the organism, such as

Bacterial Wilt of Cucurbits—Continued.

questions regarding physiological strains on the various hosts, methods of infection, viability in the soil and in animal parasites, and in seed of infected fruit, with special reference to locating the manner in which the bacteria winter over. A histological and cytological study of the relation between host and parasite will also be made.

Cooperation.—Field experiments during the season of 1915 to be carried out through cooperation with growers in an infected locality; this project also to be carried out in mutual cooperation with the Office of Cotton and Truck Disease Investigations in connection with its work in the Middle West on some other diseases of cucurbits.

Location.—The principal investigations of this project to be carried out in the Laboratory of Plant Pathology, Washington, and in the neighborhood of Greenport (Long Island), N. Y.; collecting and observation trips to be made through Maryland, Delaware, New Jersey, Michigan, Wisconsin, Indiana, and Iowa.

Date begun.—1914.

Results.—The organism causing this disease has been previously investigated and reported in Centralblatt für Bakteriologie, Band I, 1895. No. 9/10. Work upon several phases of this project is now well under way.

Probable date of completion.—January, 1918.

Assignment.—Frederick V. Rand.

Proposed expenditures, 1915–16.—$1,560.

Total, Special Investigations, $8,746.

Total, Laboratory of Plant Pathology, $31,610.

[Research.]

PATHOLOGICAL COLLECTIONS.

Pathological Herbarium:

Object.—To maintain a collection of fungi demonstrative of the important economic bearing of fungi upon agricultural crops. The specimens comprising the herbarium are arranged with a view to assisting mycological and pathological investigators in solving research problems or in the practical application of such problems.

Procedure.—Valuable pathological or mycological material is acquired by the purchase of American and foreign sets of exsiccati. Specimens identified by members of the office for mycologists, pathologists, collaborators, amateur collectors, or correspondents are retained, and other specimens are secured through the medium of the mycological exchange, through the deposition of type material by authors, through the agency of the Plant Disease Survey, and by collections made by members of the office staff.

Location.—Washington, D. C.

Date begun.—1885.

Results.—The herbarium contains over 75,000 specimens, exclusive of permanent microscopic slides. This material is systematically arranged and is available for consultation by scientific workers. A large number of specimens have been added to the collections during the past year, but owing to the European war the issuance of certain sets of foreign exsiccati has been indefinitely delayed or suspended. The following is a list of the sets of exsiccati received during the present year: Bartholomew—Fungi Columbiani, Centuries 43–46, Nos. 4201–4600; Bartholomew—North American Uredinales, Centuries 11–14, Nos. 1001–1400; Brenckle—Fungi Dakotenses, Fasc. 11–12, Nos. 251–300; Garrett—Fungi Utahenses, Fasc. 9, Nos. 201–225; Jaap—Fungi Selecti Exsiccati, Fasc. 28, Nos. 676–700; Maire—Mycotheca Boreali-Africana, Fasc. 5–7, Nos. 101–175; Rhem—Ascomycetes Exsiccati, Fasc. 53–55, Nos. 2051–2125; Sydow—Mycotheca Germanica, Fasc. 25–26, Nos. 1201–1300; Torrend—Fungi Selecti Exsiccati, Century 3, Nos. 201–300; Vestergren—Micromycetes Rariores Selecti, Fasc. 69–72, Nos. 1701–1800.

Assignment.—Flora W. Patterson.

Proposed expenditures, 1915–16.—$4,805.

Mycological Index and Host Index:

Object.—To provide information relative to new genera or species; to furnish data regarding the geographical distribution of diseases, their intensity, and measures of control or eradication.

Procedure.—The activity of this project consists of two distinct lines of work, one pertaining to the herbarium as furnishing an inventory of the fungi comprising the herbarium and their respective hosts, and the other providing abstracts, translations, and illustrations of new, contested, or imperfectly known genera, species, or diseases.

Location.—Washington, D. C.

Date begun.—1885.

Results.—The conspicuous activity in mycological and pathological lines has resulted in the acquisition of a large number of cards referring to these subjects. As in the previous year the following general divisions have been observed: Indexing of all new genera, including the generic diagnosis, a copy of the illustrations, and author's notes or comments; indexing of new species, both American and foreign; geographical index with special reference to the indigenity of species; nomenclatorial index pertaining to common names of fungi and fungous and physiological diseases of all countries and all languages; subject index, consisting of references to and abstracts from all pathological and mycological subjects, whether of a technical, general, or semipopular nature, particular attention being given to diseases the causal organisms of which have not been determined; addition of several thousands of cards to the indexes as a result of this work.

Assignment.—Flora W. Patterson.

Proposed expenditures, 1915-16.—$2,180.

Mycological Exchange:

Object.—The object of this project has been the general dissemination of economic mycological and pathological information.

Procedure.—Specimens are sent from the mycological exchange to experiment stations, agricultural institutions, collaborators, demonstrators, or teachers of agriculture in secondary schools and others especially interested in the economic study of fungi. This phase of the subject has been educational in character, but by the exchange of specimens with foreign mycologists much interesting material has been received by the office.

Cooperation.—This work is largely cooperative in character, as the sets distributed are considered exchanges, although sets of 50 specimens were given to State agricultural experiment stations which had made application for them.

Location.—Washington, D. C.

Date begun.—1898.

Results.—The work has created a more general and intelligent interest in the subject of plant pathology, proving a valuable agent for demonstration purposes.

Assignment.—Flora W. Patterson.

Proposed expenditures, 1915-16.—$1,200.

Work of Identification:

Object.—Determination of fungi in order to recommend measures for the control of plant diseases.

Procedure.—This work may be considered under two heads—pathological identification and mycological identification. Under pathological identifications are included the determination of species of fungi causing diseases of plants. Microscopic examinations are often sufficient for the solution of problems connected with well-established diseases, but new diseases always require a study of the life history of the causal organisms and relation to fungi already recognized as pathogenic. These identifications frequently require cultural work, critical microscopic comparisons with authentic specimens, and inoculation experiments Under mycological identifications may be understood the determination of fungi of taxonomic rather than pathological interest. The value of this work is constantly recognized, as field observations often reveal the parasitic nature of fungi at first supposed to be of systematic interest only.

Location.—Washington, D. C.

Date begun.—1885.

Work of Identification—Continued.

Results.—Among the fungi of especial current interest and identified first by this office may be mentioned the fungus causing the chestnut-bark disease, Chrysophlyctis and Spondylocladium on the Irish potato, *Ustilago shiraiana*, a serious smut disease of bamboos, and *Kawakamia cyperi*, an important disease of matting sedges. Under this project may be considered the preparation and publication of a bulletin on the subject of edible and poisonous mushrooms and certain other fungi. Numerous identifications of fleshy fungi are made for correspondents and amateur collectors. Inquiries and advice as to mushroom culture require a large amount of time. General questions are answered by a form letter, while specific inquiries are replied to individually. As usual, a large number of miscellaneous identifications have been made for private individuals, amateur collectors, and science teachers in elementary schools. The work of identification of Porto Rican fungi in collaboration with Mr. J. R. Johnston has had considerable attention. The investigation so far has consisted of a study of over 100 fungi, many proving to be new species, while one new genus remains to be described. A study was made of a new disease of hemp. One stage of the fungus had been reported from Italy a number of years ago, but no further mention could be found. The life history of the fungus was worked out in culture and observed in the field. It was found to consist of three different spore forms and was designated under its perfect stage as *Botryosphaeria marconii* (Cav.) Charles and Jenkins. A new peronosporaceous fungus on guava from Brazil has been the subject of investigation and the results of the study are soon to be published.

Assignment.—Flora W. Patterson.

Proposed expenditures, 1915–16.—$2,865.

Total, Pathological Collections, $11,050.

[Research.]

FRUIT-DISEASE INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—To handle administrative, clerical, and such service and laboratory work as pertains more or less to all the fruit-disease projects.

Cooperation.—Bureau of Entomology, Insecticide and Fungicide Board, and Federal Horticultural Board.

Location.—Washington, D. C.

Date begun.—1905.

Assignment.—M. B. Waite.

Proposed expenditures, 1915–16.—$8,120.

GENERAL ORCHARD DISEASES.

Pear-Blight Investigation and Eradication:

Object.—To complete the knowledge of pear blight by working out further details; to improve methods of control already devised, and to demonstrate to orchardists, inspectors, and others the best methods known; to breed pears and apples resistant to this disease, including stocks on which to graft other varieties.

Procedure.—Laboratory work, microscopical and bacteriological, is conducted; also field investigations and experiments, mostly near by in Virginia and Maryland; eradication work in the orchards in various parts of the country, particularly in California, Washington, and Oregon; breeding work in the vicinity of Washington and at Arlington, Va.

Cooperation.—Extensive cooperation in the field with State and county horticultural commissioners, fruit-tree inspectors, experiment-station workers and orchardists, particularly on the Pacific coast.

Location.—Washington, D. C.; Arlington, Va.; orchards in various parts of the country, particularly California, Washington, Oregon, Virginia, and Maryland.

Date begun.—1889.

Results.—A method of control by eradication has been discovered. This has been quite largely but not completely put into practice in different

Pear-Blight Investigation and Eradication—Continued.

sections, particularly on the Pacific coast, and has resulted in saving the pear industry in California, Washington, and Oregon, and in benefits to other pear sections.

Probable date of completion.—The research work has been practically completed, though certain phases, as the disease reappears each year, call for further detailed studies. The date of completion of the eradication work and cooperation in control of the disease is somewhat indefinite.

Assignment.—M. B. Waite.

Proposed expenditures, 1915–16.—$1,500.

Little-Peach and Peach-Yellows Investigations:

Object.—To investigate the nature, distribution, and method of control of these diseases and to assist the various States in control work.

Procedure.—This project involves certain incidental laboratory studies, but principally field-service work in promoting the control.

Cooperation.—In control work with various State and county horticultural inspectors.

Location.—Laboratory work, Washington, D. C.; field work, mainly control, probably in Michigan, New York, Pennsylvania, and Connecticut.

Date begun.—Begun by Erwin F. Smith in 1887; transferred to M. B. Waite in 1899.

Results.—The cause of these diseases has not yet been discovered. A practical method of control of peach yellows by eradication has been extensively promoted by this work. Little peach has been classified in the peach-yellows group and a practical method of control by eradication discovered and developed.

Assignment.—M. B. Waite.

Proposed expenditures, 1915–16.—$400.

Crown-Gall of Fruits:

Object.—To make available to orchardists results of research; to aid nurserymen and orchardists in eliminating the disease; to carry on field tests for this purpose.

Procedure.—Assistance is rendered to nurserymen and orchardists to control the disease and to State and local horticultural inspectors by deciding doubtful cases. Field tests are conducted in propagating healthy trees, and observations are made on the behavior of diseased trees when planted in orchards.

Cooperation.—Nurserymen, orchardists, and various State and county horticultural inspectors.

Location.—Mainly Washington, D. C.

Date begun.—1900.

Results.—Important steps toward control in nurseries have been made. The results of the work of other investigators are made available to growers.

Assignment.—M. B. Waite.

Proposed expenditures, 1915–16.—$300.

Pollination of Orchard Fruits:

Object.—To continue an old project by perfecting knowledge of certain details of pollination and fruit-setting problems.

Procedure.—Hand pollinations of blossoms are made in the orchards and the results studied.

Location.—Vicinity of Washington, D. C.

Date begun.—1890.

Results.—Important discoveries in self-sterility of fruits; improved methods of planting orchards to secure cross-pollination.

Probable date of completion.—The main project is already completed; certain points require further study.

Assignment.—M. B. Waite.

Proposed expenditures, 1915–16.—$300.

Apple Cankers of the United States:

Object.—To determine the cause of and remedy for various apple cankers and to study the life history of the causative organisms.

Procedure.—Laboratory studies, both microscopical and cultural, are made of diseased material; field tests in eradication and control in orchards conducted.

Location.—Washington, D. C., and apple orchards in various States.

Apple Cankers of the United States—Continued.

Date begun.—1903.

Results.—Accumulation of data; practical experience in control; service to a large number of fruit growers.

Assignment.—M. B. Waite.

Proposed expenditures, 1915–16.—$1,000.

Apple Black-Heart:

Object.—To find the cause of this disease and develop a remedy or control methods. This disease blackens the inside of the trunks of young apple trees, causing premature decay and often death. It often causes serious damage in the Middle Western States.

Procedure.—Laboratory studies, including bacteriological culture work, are carried on; also field examinations in various orchards and nurseries.

Location.—Principally in the Middle Western States; in Maryland and Virginia; laboratory work at Washington, D. C.

Date begun.—1903.

Results.—Preliminary bacteriological researches have been made. Crown-gall and other organisms have been found associated with the disease.

Assignment.—M. B. Waite.

Proposed expenditures, 1915–16.—$300.

Shot-Hole and Twig-Spot of Peaches and Apricots:

Object.—To differentiate the various diseases, including the gumming fungus of the peach, which is the principal one; to find the cause of the apricot spot and remedies for the same.

Procedure.—Laboratory studies and field studies, including spraying experiments.

Cooperation.—Fruit growers.

Location.—California.

Date begun.—1905.

Results.—A perfect spraying remedy has been found for the peach gumming fungus; apricot disease not yet perfected.

Probable date of completion.—Main project on the peach practically completed; on the apricot, 1918.

Assignment.—M. B. Waite, W. S. Ballard.

Proposed expenditures, 1915–16.—$200.

Nut Diseases:

Object.—To find causes of and remedies for various nut diseases and to develop control measures.

Procedure.—Usual laboratory and field investigations, including the establishment of a temporary field laboratory at Thomasville, Ga., for special study of pecan diseases in the heart of the principal pecan district.

Cooperation.—Nut growers.

Location.—Washington, D. C.; Thomasville, Ga.; and field work mainly in Georgia, Florida, Alabama, and Louisiana.

Date begun.—1909.

Results.—A thorough study of pecan scab, including methods of control, has been made; remedies devised for certain pecan leaf diseases by spraying in the nursery; rapid building up of knowledge of pecan diseases in progress.

Assignment.—S. M. McMurran.

Proposed expenditures, 1915–16.—$2,500.

Root-Rot Diseases of Fruit Trees:

Object.—To ascertain causes, life history, and methods of dissemination of the fungi responsible for root-rot diseases of fruit trees and to develop control or remedial measures.

Procedure.—This project involves laboratory work, including microscopical examinations and cultures; study of diseased trees in the orchards and of diseased nursery stock; inoculation tests and pathological investigations. It is proposed to push this project more actively in the future.

Cooperation.—Federal Horticultural Board and various horticultural inspectors over the country in identification of material.

Location.—Washington, D. C. Disease all over the United States.

Date begun.—1900.

Results.—Data and specimens accumulated but no remedy yet found.

Assignment.—M. B. Waite.

Proposed expenditures, 1915–16.—$700.

Frost Injuries to Fruit Trees:

Object.—To apply pathological methods to the study of frost injuries.

Procedure.—Frost injuries are followed up as they occur in different sections of the United States; the tissues are examined microscopically and sometimes bacteriological cultures made; data and observations, drawings, and photographs of frost injuries and records of weather conditions which produce them are accumulated. Field studies are made on the behavior of fruit trees injured in varying degrees.

Cooperation.—Fruit growers, nurserymen, cold-storage houses, and sometimes fruit-tree inspectors.

Location.—Washington, D. C., and orchards at various points.

Date begun.—1890

Results.—Better understanding of the injuries to fruit and fruit trees and methods of handling frost-injured trees.

Assignment.—M. B. Waite.

Proposed expenditures, 1915–16.—$400.

Spraying Apparatus and Spraying Efficiency:

Object.—To investigate in orchards the relative efficiency of the many types of spraying apparatus now on the market when in actual use in the control of diseases. Attention will be given to the most economical types of spraying apparatus for given kinds of work and service. An estimate of spraying efficiency as practiced by various orchardists, vineyardists, etc., will be made, as a basis for suggestions in improvement in such work.

Procedure.—Different types of spraying machinery in operation in orchards will be observed, to determine their comparative value and efficiency under varying orchard and farm conditions. In this connection observations will be accumulated on the efficiency of the work as accomplished by different individuals, and special inquiries will be made to determine wherein spraying operations do not give entirely satisfactory results as to control of diseases.

Cooperation.—This work is carried on in cooperation with the Bureau of Entomology and the Office of Public Roads and Rural Engineering. The strictly engineering and mechanical work is conducted by the Office of Public Roads and Rural Engineering. Cooperative arrangements have been made between these three bureaus with reference to the conduct of this work.

Location.—Washington, D. C.; spray-apparatus factories, orchards, and vineyards in various parts of the country.

Date begun.—Actually begun in 1886; taken up by the present leader in 1892; formulated as a joint cooperative project in 1915.

Results.—The work in past years has resulted in many detailed improvements, which have been utilized especially as suggestions to manufacturers and orchardists. Information in Farmers' Bulletins 243, 284, 440. and 492.

Assignment.—M. B. Waite.

Proposed expenditures, 1915–16.—$1,000.

Miscellaneous Orchard Diseases:

Object.—To investigate minor orchard diseases not covered in special projects and diseases which suddenly assume importance.

Procedure.—The usual pathological methods are followed, including laboratory examinations, microscopic study, culture study, and field work.

Cooperation.—Fruit growers and horticultural inspectors.

Location.—Washington, D. C.; orchards over the United States.

Date begun.—1890.

Results.—Data have been accumulated about special diseases; service rendered to orchardists and to State and experiment-station pathologists and horticultural inspectors through examination of specimens and correspondence. In case of apple cedar rust important practical benefits have been derived through the promotion of control by the destruction of the red cedars.

Assignment.—M. B. Waite.

Proposed expenditures, 1915–16.—$3,175.

Total, General Orchard Diseases, $11,775.

GRAPE AND SMALL-FRUIT DISEASES.

Cranberry Diseases:

Object.—To investigate causes, improve control and preventive methods, and study habits and life histories of causative organisms, with special reference to the blossom-end rot, black-spot, and other recently discovered troubles.

Procedure.—This project involves spraying experiments, field studies of new or recently discovered diseases, especially blossom-end rot, and trial of various methods of reducing loss from rot after harvesting. The relation of methods of picking and handling to development of rot between picking and marketing is being studied.

Cooperation.—Massachusetts Experiment Station.

Location.—Washington, D. C.; Arlington, Va.; Massachusetts, New Jersey, Oregon, and Washington.

Date begun.—1901.

Results.—Additional knowledge of the organisms causing disease, their distribution, habits, and methods of control has been accumulated. Treatment of bogs by flooding with copper-sulphate solution indicates benefit in keeping qualities of fruit.

Assignment.—C. L. Shear.

Proposed expenditures, 1915–16.—$3,500.

Grape Diseases:

Object.—To determine causes, discover or improve control methods, and study life histories and habits of causative organisms.

Procedure.—The work includes spraying experiments, laboratory investigations, studies of relative varietal resistance, and cross-inoculation experiments.

Cooperation.—New Jersey Experiment Station.

Location.—Washington, D. C.; Arlington, Va.; and Vineland, N. J.

Date begun.—1905.

Results.—Much additional knowledge of the organisms, their distribution, and control has been accumulated.

Assignment.—C. L. Shear.

Proposed expenditures, 1915–16.—$3,500.

Diseases and Rots Developing in Picking, Packing, and Transportation of Small Fruits:

Object.—To determine the organisms and conditions causing loss in picking, packing, and shipping and to develop methods of remedying such conditions.

Procedure.—Laboratory studies of organisms involved; field studies of methods of picking, handling, and shipping; and experiments for the control or removal of causes.

Cooperation.—Growers and shippers.

Location.—Washington, D. C., and various small-fruit growing centers.

Date begun.—1915.

Results.—Several fungi causing rot in the field, especially in strawberries, isolated and studied.

Assignment.—C. L. Shear.

Proposed expenditures, 1915–16.—$1,500.

Miscellaneous Small-Fruit Diseases:

Object.—To study fungous and physiological diseases of raspberries, blackberries, currants, gooseberries, and strawberries, and methods of prevention or control.

Procedure.—Eradication and sanitary methods and spraying experiments; laboratory and field studies of the organisms and conditions causing disease.

Cooperation.—Small-fruit growers.

Location.—Washington, D. C.; Arlington, Va.; and Vineland, N. J.

Date begun.—1906.

Results.—Increased knowledge of the life histories of the parasites, their importance, distribution, and control.

Assignment.—C. L. Shear.

Proposed expenditures, 1915–16.—$3.000.

Total, Grape and Small-Fruit Diseases, $11.500.

CITRUS AND SUBTROPICAL FRUIT DISEASES.

Citrus and Subtropical Fruit Diseases:

Object.—To find causes, life history of the organisms, and methods of control and extermination, especially of citrus canker.

Procedure.—The usual bacteriological and pathological laboratory and field studies are conducted, including spraying experiments and tests of fertilizer and the effects of various methods of culture on citrus diseases.

Cooperation.—State officials and associations and growers throughout the Gulf coast districts.

Location.—Washington, D. C.; temporary field laboratories at Plymouth, Orlando, and other points in Florida and on the Gulf coast.

Date begun.—Under old Division of Pathology, in 1892; later in subtropical laboratory, Miami, Fla.; transferred to Fruit-Disease Investigations in 1908; present work actually inaugurated in 1912; special experiments for control of citrus canker begun in 1914.

Results.—Preliminary studies of citrus diseases have been made and experiments are now under way. The distribution and behavior of citrus canker in the field on various citrus hosts from Florida to Texas have been determined. The bacterial nature of citrus canker was discovered and proved by Miss Clara H. Hasse in the laboratory and with greenhouse material at Washington. Paper in Journal of Agricultural Research, vol. 4, No. 1, " Pseudomonas Citri, the Cause of Citrus Canker."

Assignment.—J. G. Grossenbacher.

Proposed expenditures, 1915–16.—$10,400.

FRUIT ROTS AND SPOTS AND PHYSIOLOGICAL FRUIT DISEASES.

Fruit Rots and Spots and Certain Related Physiological Diseases:

Object.—To determine the cause and remedy for rots of deciduous orchard fruits and to study these rots after picking time and when in transit, in storage, and on the market; to study the pathological changes in the tissues in deciduous fruits produced by the punctures and sucking of insects, and distinguish between the spots resulting from insect punctures and the physiological bitter-pit; and to perfect methods of control for apple and peach powdery mildew.

Procedure.—Characteristics of rots and fungi will be studied from both mycological and physiological points of view; fruit known to be punctured by particular insects will be obtained and the general and microscopic effects studied; spraying experiments in devising and testing new fungicides for powdery mildew will be undertaken.

Cooperation.—Insecticide and Fungicide Board; Bureau of Entomology; Entomologist, Santa Cruz County, Cal.

Location.—Washington, D. C.; Vancouver and Wenatchee, Wash.; Salem. Oreg.; Vienna, Va.; Watsonville, Cal.; storage work in various sections.

Date begun.—1888–1890.

Results.—A large number of fungi have been isolated and their power to produce rots under various storage conditions determined. The blossom infection of brown-rot on prunes and cherries has been found to be very extensive in the Columbia and Willamette Valleys, and spraying experiments have shown the possibility of controlling the trouble under the conditions existing there. The stigmonose disease has been more clearly set off from bitter-pit and other related troubles. and some insects of importance have been determined and their effects studied. A practical method of control in the Watsonville, Cal., district for powdery mildew has been discovered to be by spraying with iron-sulphid mixture. Department Bulletin 120, "Apple Powdery Mildew and Its Control in the Pajaro Valley," published.

Assignment.—Charles Brooks, W. S. Ballard, J. S. Cooley, D. F. Fisher.

Proposed expenditures, 1915–16.—$4,800.

Fruit-Spot of Jonathan and of Grimes and Other Yellow Apples, and Apple Bitter-Pit:

Object.—To determine the nature of these diseases, their causes, and methods of prevention.

Procedure.—A study will be made of the effect of nutrition, water supply, cultural methods, and various conditions of storage on apple bitter-pit. Irrigation and fertilizer experiments will be made in Jonathan, Grimes,

Fruit-Spot of Jonathan and of Grimes and Other Yellow Apples, and Apple Bitter-Pit—Continued.

and other yellow-apple orchards; and particular study will be made of apples after they are picked and when in transit, in storage, and on the market.

Location.—Washington, D. C.; Wenatchee, Wash.; Salem, Oreg.; and various other points in the United States.

Date begun.—On apple bitter-pit in 1909; fruit-spot of yellow apples in 1912.

Results.—Data have been obtained that separates the apple bitter-pit disease from other closely related troubles. Some of the orchard conditions which influence the amount and development of the bitter-pit and fruit-spot of the yellow apples have been determined.

Assignment.—Charles Brooks, D. F. Fisher.

Proposed expenditures, 1915–16.—$3,500.

Miscellaneous Physiological Fruit Diseases:

Object.—To determine the effect of soil and subsoil constituents on fruit diseases, including the relation of artificial ingredients in the soil to orchard diseases; to study the causes of certain unknown diseases supposed to be due to unfavorable environment, and to discover the cause and remedy of the various diseases of the chlorotic type and distinguish between the principal types.

Procedure.—Apply physiological and pathological methods to the study of diseased orchards; study the effect of climatic conditions, especially on the nonparasitic diseases; investigate soil conditions, chemical and mechanical, and the relation of soil moisture to certain diseases. Microscopic and laboratory investigations will be conducted; also field investigations of the new disease known as "little leaf" of the peach in California, a supposedly physiological trouble.

Cooperation.—Orchardists, fruit growers, and State and county horticultural commissioners in various sections.

Location.—Washington, D. C.; Watsonville, Cal.; and Western States; on peach little leaf, San Joaquin Valley, Cal.

Date begun.—1891.

Results.—Data have been accumulated regarding these little-known diseases and in regard to the nature and distribution of chlorotic diseases. The "little apricot" trouble in Idaho has been identified as a subsoil and irrigation difficulty. The important discovery of the benefits of winter spraying with nitrate of soda in California has been made and extended to Washington and Oregon. Publication: "Winter Spraying with Solutions of Nitrate of Soda," Journal of Agricultural Research, vol. 1, No. 5.

Assignment.—W. S. Ballard.

Proposed expenditures, 1915–16.—$6,000.

Total, Fruit Rots and Spots and Physiological Fruit Diseases, $14,300.

ORCHARD-SPRAYING EXPERIMENTS.

Investigations of Apple Bitter-Rot, Blotch, and Leaf Diseases, Peach and Plum Brown-Rot and Scab, and Japanese Plum Disease:

Object.—To develop routine systems of spraying; test the use of combination sprays of insecticides and fungicides; obtain information on the life histories of the causative fungi or other organisms, especially as to manner of wintering, and determine the nature and best means of eradication or control of each of these diseases.

Procedure.—Field and laboratory studies of a bacteriological, pathological, and mycological nature are conducted to determine the results of spraying tests and of inoculation tests and cultures for the isolation of various fungi, and to perfect and improve the methods of control and eradication of the cankers and other diseases.

Cooperation.—Bureau of Entomology, in the peach and plum brown-rot and scab investigations and general orchard-spraying experiments.

Location.—Washington, D. C.; Virginia, Maryland, Arkansas, Missouri, Illinois, and other States.

Date begun.—Apple bitter-rot, 1903; blotch and orchard-spraying experiments, 1906; peach and plum brown-rot and scab investigations, 1904; apple-leaf disease, 1909; Japanese plum disease, 1902.

Investigations of Apple Bitter-Rot, Blotch, and Leaf Diseases, Peach and Plum Brown-Rot and Scab, and Japanese Plum Disease—Continued.

Results.—Combined spraying schedules for the apple and peach in various sections perfected; treatment of brown-rot and peach scab perfected; good results on other stone fruits; data in Farmers' Bulletin 440. Successful treatment found for bitter-rot and blotch by late summer spraying with Bordeaux mixture and under unfavorable conditions by eradicating all cankers, including minor cankers and dead twigs in the winter; data in Farmers' Bulletin 492 and Journal of Agricultural Research, vol. 4, No. 1, "Sources of the Early Infections of Apple Bitter-Rot." Differentiation of several leaf diseases and proof of their cause by various fungi. Improved methods in the control of these diseases in the orchards. Farmers' Bulletin 492 and Journal of Agricultural Research paper, "Experiments with Apple Leaf-Spot Fungi," vol. 2, No. 1.

Assignment.—John W. Roberts.

Proposed expenditures, 1915–16.—$5,800.

Total, Fruit-Disease Investigations, $61,535.

[Research.]

INVESTIGATIONS IN FOREST PATHOLOGY.

SUPERVISION.

Supervision:

Object.—To care for office and laboratory routine.

Location.—Washington, D. C.

Date begun.—1907.

Assignment.—Haven Metcalf.

Proposed expenditures, 1915–16—$4,040.

DISEASES OF ORNAMENTAL AND SHADE TREES AND SHRUBS.

Miscellaneous Diseases of Shade and Ornamental Trees and Shrubs:

Object.—Investigation of these diseases with reference to control.

Procedure.—Studies are made to determine the weak points in the life history of these diseases; studies to improve and standardize methods of tree surgery; studies of varietal and specific resistance to disease.

Cooperation.—Department of Botany, Brown University, Providence, R. I.

Location.—Washington, D. C., and Providence, R. I.

Date begun.—1907.

Results.—Many demonstrations have been made of the best methods of tree surgery and disease treatment; certain standard methods published (Department Yearbook for 1913); increased use of ginkgo as a result of demonstration of its resistance to disease and smoke; thousands of inquiries regarding these diseases from correspondents all over the United States answered.

Assignment.—J. F. Collins.

Proposed expenditures, 1915–16.—$2,912.

Survey of Diseases of Shade and Ornamental Trees and Shrubs:

Object.—To record the distribution, extent, and annual occurrence of diseases of shade and ornamental trees and shrubs in the United States, with particular reference to their danger as possible epidemics.

Procedure.—Data are collected by correspondents and collaborators, and by members of this office in connection with field work on other projects. Studies are also made of fungus herbaria collections.

Location.—Washington, D. C.; Providence, R. I.; and generally throughout the United States.

Date begun.—1913.

Results.—Several new and potentially dangerous diseases have been discovered and measures taken to control their spread.

Assignment.—Haven Metcalf, J. F. Collins, Perley Spaulding.

Proposed expenditures, 1915–16.—$1,888.

Total, Diseases of Ornamental and Shade Trees and Shrubs, $4,800.

PATHOLOGICAL PROBLEMS IN WOOD PRESERVATION.

Decay of Mining Timbers:

Object.—To secure knowledge of the exact cause of decay in mining timbers, with a view to improving methods of preservation.

Procedure.—Visiting mines, locating and identifying the fungi causing the most serious timber rot, and determining their sensitiveness to various wood preservatives.

Cooperation.—Forest Products Laboratory, Forest Service.

Location.—Madison, Wis.

Date begun.—1909.

Results.—Definite knowledge of the causes of certain types of decay of mining timbers has been obtained.

Probable date of completion.—July 1, 1916.

Assignment.—C. J. Humphrey.

Proposed expenditures, 1915–16.—$680.

Pathological Problems of Deterioration of Fire-Killed Timber:

Object.—To determine the relation of fungi and associated conditions to the deterioration of fire-killed timber.

Procedure.—Detailed field studies are made in burnt-over tracts, with subsequent life history and identification studies of the saprophytic fungi involved.

Cooperation.—Forest Service.

Location.—National Forest District No. 1; headquarters, Missoula, Mont.

Date begun.—1912.

Results.—Definite knowledge of deterioration factors obtained in the cases studied.

Probable date of completion.—July 1, 1917.

Assignment.—James R. Weir.

Proposed expenditures, 1915–16.—$985.

Miscellaneous Pathological Problems of Wood Preservation:

Object.—To work out miscellaneous problems on the pathological aspects of wood preservation.

Procedure.—The work involves studies of the specific toxicity of wood preservatives against certain saprophytes; of the cause, conditions, and possible means of control of decay in building timbers, especially under yard and storage conditions; of the histology and cytology of wood rot in general; of the natural resistance of various species of wood to decay.

Cooperation.—Forest Products Laboratory, Forest Service.

Location.—Madison, Wis.

Date begun.—1909.

Results.—Definite knowledge has been obtained as to the causes and conditions of various wood rots and the specific action of various preservatives; practical results reflected in the wood-preservation work of the Forest Products Laboratory.

Assignment.—C. J. Humphrey.

Proposed expenditures, 1915–16.—$2,660.

Total, Pathological Problems in Wood Preservation, $4,325.

FOREST-TREE DISEASES.

Effects of Sulphur and Other Gases on Forest Trees:

Object.—To study effects and conditions with reference to control or abatement.

Procedure.—The work will be limited this year to laboratory studies and the preparation of results for publication, unless new litigation arises calling for expert testimony.

Cooperation.—Forest Service.

Location.—Washington, D. C.; Anaconda, Mont.; and Ducktown, Tenn.

Date begun.—1904.

Results.—Information, especially in reference to degree and distance of damage, relative resistance of species, etc., has been collected and is available for correspondence, expert testimony, etc.

Probable date of completion.—July 1, 1916.

Assignment.—George G. Hedgcock.

Proposed expenditures, 1915–16.—$959.

Diseases of Forest Nursery Stock:

Object.—Investigation of these diseases with reference to control.

Procedure.—This project involves the testing of the effects of various soil fungicides and amendments, of spraying, and of modifications of nursery practice on "damping-off" and other nursery diseases.

Cooperation.—Forest Service and private nurserymen.

Location.—Cass Lake, Minn.; East Tawas, Mich.; Wasatch National Forest; and many other national and private forest nurseries in 11 States.

Date begun.—1910.

Results.—Effective commercial control of these diseases has been effected in the localities studied.

Assignment.—Carl Hartley, Roy G. Pierce.

Proposed expenditures, 1915–16.—$9,355.

Preliminary Disease Survey of the National and Other Forests:

Object.—To secure fundamental knowledge on present conditions of the forests of the United States with respect to disease.

Procedure.—Data are collected by members of the office in connection with field work on other projects, and by correspondents and collaborators, on the distribution, extent, and annual occurrence of various tree diseases Studies are also made of herbaria and fungus collections.

Cooperation.—Forest Service.

Location.—Washington, D. C.; Madison, Wis.; Missoula, Mont.; Albuquerque, N. Mex.; San Francisco, Cal.; and generally throughout the United States.

Date begun.—1907.

Results.—Substantial contributions have been made to the knowledge of the range, seriousness, and significance in forestry of various tree diseases.

Probable date of completion.—January 1, 1918.

Assignment.—George G. Hedgcock.

Proposed expenditures, 1915–16.—$2,058.

Cooperative Field Studies and Demonstrations in Forest Pathology:

Object.—To determine the best methods of controlling tree diseases, particularly in the national forests.

Procedure.—From detailed and statistical studies of diseased trees in typical areas, rotation and cutting cycles based on diseases are established and improved marking and scaling methods developed.

Cooperation.—Forest Service.

Location.—Missoula, Mont.; Albuquerque, N. Mex.; San Francisco, Cal.; and generally throughout National Forest Districts 1, 3, 5, and a few localities in District 6.

Date begun.—1913.

Results.—Development of methods now in regular use in enforcing the "sanitary clause" in timber-sale contracts; improved methods of handling certain of the so-called "decadent species."

Assignment.—E. P. Meinecke, James R. Weir, W. H. Long.

Proposed expenditures, 1915–16.—$10,252.

Miscellaneous Forest-Tree Diseases:

Object.—Investigation, with reference to control, of the nature and life history of various tree diseases.

Procedure.—The usual methods of investigation of plant diseases are applied to forest-tree diseases.

Coperation.—Forest Service.

Location.—Washington, D. C.; Providence, R. I.; Madison, Wis.; Missoula, Mont.; Albuquerque, N. Mex.; and San Francisco, Cal.

Date begun.—1913.

Results.—Fundamental contributions made to the knowledge of about 30 diseases.

Assignment.—Haven Metcalf, George G. Hedgcock.

Proposed expenditures, 1915–16.—$4,776.

Total, Forest-Tree Diseases, $27,400.

IMPORTED AND EPIDEMIC TREE DISEASES.

Imported and Epidemic Tree Diseases:

Object.—Investigation of the white-pine blister rust, the chestnut bark disease, the pitch-pine blister rust, and other imported and epidemic tree diseases, with reference to their control.

Procedure.—In the course of work under projects, "Survey of diseases of shade and ornamental trees and shrubs" and "Preliminary disease survey of the national and other forests," the attention of this office is called to these diseases. Their life histories are then studied to find weak points for attack and their range, origin, and means of spread determined. Under this project the fundamental problems of spread and adaptation of introduced diseases and the problems of susceptibility of native tree species to foreign diseases are being studied.

Cooperation.—Federal Horticultural Board; also informal cooperation with State foresters, firms, and private individuals.

Location.—Washington, D. C.; Providence, R. I.; and various field points in Vermont, New Hampshire, Massachusetts, New York, Pennsylvania, New Jersey, Virginia, and other States.

Date begun.—1907.

Results.—The importation of 5-leaf pines has been prohibited. The white-pine blister rust has apparently been eliminated wherever found. The real nature and origin of the chestnut bark disease has been discovered; the manner of its distribution determined; extensive destruction of advance infections effected; utilization of disease-killed trees made possible; resistant and immune Asiatic strains discovered, and also other favorable stock for breeding for resistance. Fundamental contributions have been made to the knowledge of these diseases, the pitch-pine blister rust, and other diseases of similar character.

Assignment.—Haven Metcalf, Perley Spaulding.

Proposed expenditures, 1915–16.—$21,130.

Total, Investigations in Forest Pathology, $61,695.

[Research.]

COTTON AND TRUCK DISEASE INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—To provide for administrative, clerical, and routine laboratory work necessary for the proper conduct of the research projects.

Location.—Washington, D. C.

Date begun.—1901.

Assignment.—W. A. Orton, H. A. Edson.

Proposed expenditures, 1915–16.—$15,462.

COTTON DISEASES.

General Investigation of Cotton Diseases:

Object.—To study cotton diseases, discover preventive or remedial treatment, and breed resistant varieties, especially early, big-bolled, wilt-resistant varieties adapted to boll-weevil conditions in the eastern part of the cotton belt. The latter phase is nearing completion. Pathological studies, especially on root-rot, need to be extended.

Procedure.—General pathological work is carried on in the Washington laboratory. Resistance breeding is conducted on plats of infected land rented from farmers.

Location.—Washington, D. C.; Monetta and Florence, S. C.; and other points in the Southern States.

Date begun.—The general studies in 1899, the first wilt-resistant breeding in 1901, and the breeding for early big-bolled sorts in 1908.

Results.—Three promising new strains now in increase plats; others, including long-staple, wilt-resistant, Upland types, under test; methods of control for cotton diseases, published in B. P. I. Bulletin 105 (part 2), B. P. I. Circular 9, and Farmers' Bulletin 555, demonstrated to be successful.

General Investigation of Cotton Diseases—Continued.

Probable date of completion.—Wilt studies in 1916; wilt-resistant breeding in 1917.

Assignment.—W. A. Orton, W. W. Gilbert, L. O. Watson, C. A. McLendon.

Proposed expenditures, 1915–16.—$1,308.

Cooperative Wilt-Resistant Cotton and Cowpea Breeding:

Object.—To instruct farmers in methods of breeding wilt-resistant cotton and cowpeas, stimulate production of resistant seed, and demonstrate methods for control of root-knot; also to maintain a connection between the bureau investigators and department and State extension workers.

Procedure.—The project leader works with a collaborator in each State to train plant breeders in the State, guide them in their methods, and stimulate the production of pure strains of the resistant varieties originated by the department. Demonstrations are carried out through county and local agents, whom the project leader instructs in plant-disease control through personal visits and attendance at meetings. The county and local agents pass the information on to the farmers. This project will be closed as soon as the work is ready to turn over to the States Relations Service.

Cooperation.—South Carolina and Alabama experiment stations.

Location.—Florence, S. C.; Auburn, Ala.; and other points in the States named.

Date begun.—1911.

Results.—The work in Georgia has been fully organized and turned over to the State. The South Carolina work is well organized, and a large number of cooperative breeders are each year raising wilt-resistant cotton and wilt and root-knot resistant cowpeas, under the supervision of this department, for sale to growers. In Alabama a good beginning has been made and a number of cooperative breeders located who will raise wilt-resistant seed this year. Close relations are maintained with extension workers. Results published in Bureau of Plant Industry Document 648, B. P. I. Circular 92, and Farmers' Bulletin 565.

Probable date of completion.—In South Carolina and Alabama, 1917.

Assignment.—L. O. Watson, C. A. McLendon, H. B. Tisdale.

Proposed expenditures, 1915–16.—$2,840.

Total, Cotton Diseases, $4,148.

TRUCK-CROP DISEASES.

Potato Diseases:

Object.—To discover causes and methods of prevention or control of the more important potato diseases, particularly those involved in the interstate seed industry, and the more difficult problems requiring long-continued investigation, collaboration of several specialists, experimentation in different States, or relating to Federal quarantines.

Procedure.—The general pathological studies are prosecuted in the Washington laboratories in winter and at the field stations in summer. All work is closely correlated with the potato investigations of the Office of Horticultural and Pomological Investigations, being located at the same field stations in Maine, Colorado, and Idaho. The disease resistance of their new varieties is tested by inoculation in the Washington greenhouses, as well as in fields, and cytological studies are made to determine the nature of disease resistance. The potato diseases transmitted by seed tubers are studied and healthy strains produced in the North and tested in the South and West. In general, the investigations are of an exhaustive or monographic character and carried out from a national viewpoint. Results of local application are made available to the States for extension purposes. The Wisconsin, Colorado, and Idaho studies are closely interrelated. The Office of Plant Physiological and Fermentation Investigations in this bureau cooperates in a study of tuber rots, particularly the western "leak."

Cooperation.—The experiment stations of Idaho, Wisconsin, and Colorado and the board of commissioners of Weld County, Colo.; informal cooperation with other stations and with farmers.

Potato Diseases—Continued.

Location.—Presque Isle and Caribou, Me.; Jerome, Idaho; Greeley, Colo.; Waupaca, Wis.; Norfolk, Va.; and other points.

Date begun.—1908.

Results.—New field stations have been organized in Maine, Wisconsin, and Colorado. Potato late-blight has been proved to winter over in tubers and field epidemics arise from planting infected seed tubers; resistance of varieties tested by new method; crop losses shown to be due in part to new diseases, leaf-roll, curly-dwarf, mosaic, streak, etc., and largely preventable through seed selection; field methods for the production of disease-free seed potatoes demonstrated practicable; causes of tuber rots determined and control through careful handling and cool storage indicated; life history of powdery scab nearly worked out; several publications issued, namely, Farmers' Bulletins 489 and 544, B. P. I. Circulars 23, 52, and 127, and Department Bulletins 64, 81, and 82; general interest in the control of potato diseases greatly stimulated.

Assignment.—H. A. Edson, I. E. Melhus, V. W. Pool, L. O. Kunkel, C. W. Carpenter, O. A. Pratt, M. B. McKay, Lon A. Hawkins, Jos. Rosenbaum, H. G. MacMillan.

Proposed expenditures, 1915–16.—$21,920.

Potato Seed Inspection and Certification:

Object.—To provide a means for improving the quality of potato stock, particularly that entering into interstate trade, with reference to freedom from disease, trueness to type, and freedom from varietal mixture; and to assist the States in bringing about its successful establishment.

Procedure.—A plan for inspection and certification of seed potatoes is being perfected for adoption by the States. The Bureau of Plant Industry does not issue any certificates, but cooperates with State officers by furnishing advice and information gained through its potato-disease and varietal investigations.

Cooperation.—Informal cooperation with experiment stations and departments of agriculture or horticulture in the several potato-growing States.

Location.—Washington, D. C., and all principal potato States.

Date begun.—1914.

Results.—The plan has been adopted by the States of Wisconsin, Maine, Michigan, and Minnesota, and is being inaugurated in New York, Vermont, and California. Much benefit to the potato industry is resulting through the production of better seed and increased interest in disease control and marketing problems. Uniform standards for seed potatoes have been formulated and are in a fair way toward adoption by the States. Purchasers of seed potatoes are being led to demand higher quality.

Assignment.—W. A. Orton, William Stuart.

Proposed expenditures, 1915–16.—$600.

Sweet-Potato Diseases:

Object.—To study the several sweet-potato diseases and discover means of control.

Procedure.—Thorough pathological studies are made in the Washington laboratory, including inoculation experiments and tests in greenhouses and gardens. Field trials of control methods in farmers' hotbeds and fields are made, and general surveys of the country are conducted to discover the occurrence and prevalence of the diseases. The work in the East is being transferred to the extension forces as its several phases are completed. Diseases of the Southern and Central States will require more attention in the early future, and troubles connected with storage conditions remain to be worked out.

Cooperation.—Virginia Truck Experiment Station; informal cooperation with farmers in New Jersey and Virginia.

Location.—Washington, D. C.; Vineland, N. J.; and Norfolk and Tasley, Va.

Date begun.—1911.

Results.—The dry-rot, foot-rot, and stem-rot diseases of sweet potatoes investigated and the results published. Successful control measures for stem-rot and black-rot worked out; investigations of the resistance of different varieties to stem-rot completed; rotation experiments in progress. Some of the results of this work are contained in the following publications: "The Stem-Rot of the Sweet Potato," Phytopathology, vol.

Sweet-Potato Diseases—Continued.

4, No. 4; "The Foot-Rot of the Sweet Potato," Journal of Agricultural Research, vol. 1, No. 3; "Notes on the Distribution and Prevalence of Three Important Sweet-Potato Diseases," in press, to be published in an early number of Phytopathology; "Experiments on the Susceptibility of Sweet-Potato Varieties to Stem-Rot," Phytopathology, vol. 5, No. 3.

Assignment.—L. L. Harter.

Proposed expenditures, 1915–16.—$3,500.

Malnutrition of Truck Crops:

Object.—To determine the causes and means of control of diseases of truck crops associated with abnormal soil conditions, excessive fertilizing, continuous cropping, etc.

Procedure.—Laboratory studies on diseased material are conducted in cooperation with the Office of Plant Physiological and Fermentation Investigations in this bureau; field tests with fertilizers, soil treatment, green manures, etc. New work is being done on this problem and should be continued on a small scale for several seasons.

Cooperation.—Virginia Truck Experiment Station.

Location.—Washington, D. C., and Norfolk, Va.

Date begun.—1906.

Results.—This trouble has been found controllable by liming the soils and filling them with humus. Since the publication of these results in Bulletins 1 and 4 of the Virginia Truck Experiment Station, the disease has largely disappeared, except on spinach.

Assignment.—L. L. Harter.

Proposed expenditures, 1915–16.—$230.

Breeding Rust-Resistant Asparagus:

Object.—To secure improved strains of asparagus immune to rust.

Procedure.—All obtainable forms of asparagus were subjected to field infection and from one, Reading Giant, resistant individuals were selected and crossed, their progeny compared, and the most desirable breeding stock isolated. The search continues for still better strains. Seedlings are grown and distributed. The work is now extended to South Carolina, and the project will be continued until resistant varieties are fully established in commercial culture.

Cooperation.—Massachusetts Experiment Station and the Massachusetts Asparagus Growers' Association.

Location.—Washington, D. C., and Concord, Mass.

Date begun.—1906.

Results.—The new method of breeding asparagus resistant to rust is applicable also to improvement in quality. The resistant strains originated possess much promise. The testing and propagation of these varieties by growers in different localities is already under way. It is practically certain that the asparagus-rust problem is solved.

Assignment.—J. B. Norton.

Proposed expenditures, 1915–16.—$3,500.

Cucumber Diseases:

Object.—To study the diseases of cucumbers, especially those causing recent losses in the pickle-growing sections; to develop and test methods for their control, breed disease-resistant varieties, and to determine the effect of fungicides on the setting of cucumber fruit.

Procedure.—The pathological studies will be divided among department and State investigators and conducted both in Washington and at one field station in each State. Spraying, varietal, and fertilizer tests and crop-rotation experiments will be conducted at three points in the States where the heaviest losses have occurred.

Cooperation.—Experiment stations of Indiana, Wisconsin, and Michigan, and the H. J. Heinz Co., of Pittsburgh, Pa.

Location.—Washington, D. C.; Plymouth, Ind.; Princeton, Wis.; and Big Rapids, Mich.

Date begun.—1915.

Probable date of completion.—1920.

Assignment.—W. W. Gilbert, M. W. Gardner.

Proposed expenditures, 1915–16.—$4,500.

Cabbage Diseases:

Object.—To produce varieties of cabbage which shall be resistant to the Fusarium wilt disease, adapted to the different cabbage-growing sections, and of suitable quality for commercial use, extending to other States the work successfully begun by the Wisconsin Experiment Station.

Procedure.—During the first year the work will consist of a survey of the cabbage districts, to determine the prevalence of Fusarium wilt and the requirements of the industry, to select land for future field experiments, begin the selection of resistant types, and make the necessary business arrangements. Seed of wilt-resistant strains already bred in Wisconsin will be tested at the other cooperating stations on infected land, together with commercial varieties adapted to local conditions. In subsequent years the breeding will be continued and will enlarge.

Cooperation.—Wisconsin, Maryland, Delaware, North Carolina, and South Carolina experiment stations.

Location.—Madison, Wis.; College Park, Md.; Newark, Del.; West Raleigh, N. C.; and Clemson College, S. C.

Date begun.—1915.

Probable date of completion.—1920.

Assignment.—L. L. Harter.

Proposed expenditures, 1915–16.—$300.

Monograph of Fusarium:

Object.—To work out the life history of parasitic species of Fusarium and determine their relationship to plant disease.

Procedure.—Comparative cultural studies are made in the laboratory of all obtainable parasitic forms, checked by inoculation tests in greenhouse, garden, and thermostat. The field phases of Fusarium diseases are handled under cotton, potato, and other projects.

Location.—Washington, D. C; Berlin and other points in Europe.

Date begun.—1911.

Results.—Differentiation of 100 species and varieties into 10 sections and 6 subsections; a method of study perfected, enabling species to be determined by morphological characters; the wilt-producing parasites classified in one group and the relation of other species to potato dry-rot, etc., determined in a manner of fundamental value in pathology: a comparison of pure-culture strains with species of the important exsiccata collections of Europe partially completed; the important Fusaria connected with sweet-potato diseases described and the results published in Journal of Agricultural Research, vol. 2, No. 4, "Identification of Species of Fusarium Occurring on the Sweet Potato, Ipomoea Batatas."

Probable date of completion.—1916.

Assignment.—H. W. Wollenweber, C. W. Carpenter.

Proposed expenditures, 1915–16.—$3,620.

Nematode Diseases of Truck Crops:

Object.—The investigation of diseases of truck crops and related plants caused by parasitic nematodes and the discovery and application of remedial measures.

Procedure.—Laboratory and greenhouse studies of parasitic eelworms, their life history and method of attack, are made in Washington. Field experiments with control measures, especially crop rotations, are under way. During the next year efforts will be made to free the department propagating gardens in Florida from root-knot. The work will be extended as opportunity permits to lessen the enormous losses now caused in the South and Southwest by these parasites.

Cooperation.—South Carolina Experiment Station.

Location.—Washington, D. C.; Florence, S. C.; and other points to be selected later.

Date begun.—1914.

Results.—The general outlines of farm methods of control determined; special results obtained with dasheens through application of hot water and cyanid fumigation; Farmers' Bulletin 648, "The Control of Root-Knot," published.

Assignment.—L. P. Byars.

Proposed expenditures, 1915–16.—$3,000.

Miscellaneous Truck-Crop Diseases:

Object.—To determine the causes of truck-crop diseases and find methods for suppression and control.

Procedure.—This project includes the necessary work done on lesser problems and on suspended or nearly closed projects and the identification of material received at Washington from correspondents. It involves mainly laboratory work in Washington, with some field trips to meet emergency calls.

Location.—Washington, D. C.

Cooperation.—Informal cooperation with several State experiment stations.

Date begun.—1901.

Results.—Numerous diseases identified and correspondents advised regarding treatment; a new tomato fruit rot caused by *Phoma destructiva* worked out and published; two wilt diseases of okra differentiated and causes determined; cooperation with State stations on tomato diseases secured; the causes and methods of control determined for all of the most important ginseng diseases, and the life histories of the parasites studied; demonstrations of control methods, especially spraying and soil sterilization, made to the ginseng growers; results published in B. P. I. Bulletin 250, and a number of other papers ready for publication. Other publications on miscellaneous truck-crop diseases are: "Phoma Destructiva, the Cause of a Fruit Rot of the Tomato," Journal of Agricultural Research, vol. 4, No. 1; "Fruit-Rot, Leaf-Spot, and Stem-Blight of the Eggplant Caused by Phomopsis Vexans," Journal of Agricultural Research, vol. 2, No. 5.

Assignment.—W. A. Orton, L. L. Harter, W. W. Gilbert, I. E. Melhus, J. B. Norton, C. W. Carpenter, F. J. Pritchard, L. O. Kunkel, L. P. Byars.

Proposed expenditures, 1915–16.—$2,500.

Total, Truck-Crop Diseases, $43,670.

FORAGE-CROP DISEASES.

Forage-Crop Diseases:

Object.—To study diseases of forage crops, especially alfalfa, clover, and cowpeas, and to work out control measures.

Procedure.—Laboratory studies are conducted on a small scale. Disease-resistant cowpeas are grown in field plats, and the general conditions governing disease resistance in other legumes studied. The relation of fungi to clover sickness has been taken up, and other minor activities are pending, awaiting larger support.

Location.—Washington, D. C., and other points.

Date begun.—1900.

Results.—Laboratory studies on material received from various sources have been made and a number of diseases identified; causes and control measures for many diseases of cowpeas determined and wilt-resistant varieties produced; notes collected on the distribution of alfalfa diseases and a mimographed circular on "Crown Wart of Alfalfa" prepared; further field observations made on the prevalence and distribution of important forage-crop diseases.

Assignment.—L. L. Harter, L. O. Watson, F. J. Pritchard.

Proposed expenditures, 1915–16.—$1,800.

Total, Cotton and Truck Disease Investigations, $65,080.

[Research.]

CROP PHYSIOLOGY AND BREEDING INVESTIGATIONS.

Supervision:

Object.—This project covers the general office work necessary in connection with the scientific experiments of the office.

Location.—Washington, D. C.

Date begun.—1906.

Assignment.—Walter T. Swingle.

Proposed expenditures, 1915–16.—$5,450.

Testing Farms on Indian Reservations:

Object.—To test crops promising for culture by the Indians themselves and to train them in the methods of handling the crops likely to be grown, with the help of Indian labor, by white settlers on lands adjoining the reservations.

Procedure.—Preliminary trials are made of garden and field crops, and then a special study made of any that seem likely to prove of value to the Indians. While most attention is devoted to the study of crops that may be grown profitably by the Indians themselves, crops demanding hand labor are also studied, to determine the best methods for the utilization of Indian labor.

Cooperation.—Office of Indian Affairs, Department of the Interior.

Location.—Principal testing farm at Sacaton, Ariz.; minor stations at Shiprock, N. Mex., Palm Springs, Cal., and Pyramid Lake, Nev.

Date begun.—1907.

Results.—The most important direct result of the work under this project has been the addition of Egyptian cotton to the list of crops grown by the Indians. Besides, the introduction of this new industry among the white settlers in the Salt River Valley near the Sacaton station has given the Indians an opportunity to earn good wages picking cotton for these settlers. It is estimated that during the past year the Indians received not less than $40,000 for this, while they sold the cotton raised on their reservation farms, and for the most part picked by the Indian women and children, for approximately $10,000. In addition to Egyptian cotton, many other crops, including choice disease-free Bermuda onions, dates, figs, pistaches, grapes, pears, pecans, corn, alfalfa, sorghum, sugar cane, etc., are being grown to test their value for culture by the Indians.

Assignment.—Walter T. Swingle, S. C. Mason; E. W. Hudson, foreman of the Sacaton station.

Proposed expenditures, 1915–16.—$11,223.

Date Culture and Breeding:

Object.—To establish date culture on a commercial scale in the United States and by breeding to develop new varieties better suited to American conditions than any of the imported sorts.

Procedure.—A careful study was made of the soil and climatic requirements of different date varieties to determine accurately the regions in which they would be most likely to succeed. This study was especially necessary because the date palm can not be grafted, and, if unsuitable varieties are planted, the date orchard is apt to prove a total loss. Experiments are also being conducted to find methods for the identification of varieties, for the rapid propagation of choice or rare sorts, and for the artificial ripening of fruits in unfavorable seasons.

Cooperation.—University of Arizona at Tempe, Ariz.; University of California at Mecca, Cal.; private growers in Arizona, California, and Texas.

Location.—Government Date Garden, Indio, Cal.; cooperative date gardens at Tempe and Phoenix, Ariz.; Mecca and El Centro, Cal.; and Laredo, Tex.; numerous experiments in cooperation with private growers in Arizona, California, and Texas.

Date begun.—Preliminary work of introduction, etc., in 1898; active work under this project inaugurated in 1904.

Results.—The date palm, which at the beginning of the work under this project was merely a botanical curiosity in this country, is now the basis of one of the great prospective fruit industries of the Southwest. Offshoots of practically every important Old World date variety have been imported, and there is now in the date gardens of this country a larger collection of date varieties than can be found in any one oasis of the Old World. A method for the identification of varieties by their leaf characters has been worked out, the ripening of fruit artificially in unfavorable seasons made possible, and good progress made in the experiments in the rapid propagation of offshoots.

Assignments.—Walter T. Swingle, S. C. Mason; Bruce Drummond, foreman of the Government Date Garden at Indio.

Proposed expenditures, 1915–16.—$14,777.

Caprification of the Fig and Breeding New Varieties of Figs and Caprifigs:

Object.—To discover economical and practical methods for the caprification of Smyrna figs in order to establish their culture on a commercial scale in this country; to study the possibilities for caprifying figs of the non-Smyrna type.

Procedure.—The plan is, first, to secure as large an assortment as possible of caprifigs adapted to American conditions, with a view to insuring the permanent naturalization of the fig insect (Blastophaga), which is necessary for the caprification of Smyrna figs; second, to develop by breeding new types of Smyrna figs and caprifigs especially suited to American conditions; and, third, to assist growers by distributing free the caprifigs necessary for the fertilization of their Smyrna figs and to place at their disposal any valuable new types originated in the breeding experiments.

Cooperation.—Private growers.

Location.—Loomis and other points in California.

Date begun.—Preliminary work in 1898; active work under this project inaugurated in 1904.

Results.—Although Smyrna fig culture had been a complete failure in America prior to the introduction of the fig insect (Blastophaga) by the leader of this project, a few Smyrna figs were grown in California a year after the insect's introduction, and the yield has gradually increased until now that State is producing more than 3,500 tons of dried figs annually. Approximately 15,000 additional acres in California have been set aside for fig plantations during the past three years, owing to the encouragement given growers by the department's free distribution of seedlings and cuttings of the choice new varieties originated in the Maslin Seedling Fig Orchard at Loomis, Cal.

Assignment.—Walter T. Swingle, G. P. Rixford.

Proposed expenditures, 1915–16.—$4,966.

Breeding of Citrus Fruits:

Object.—To develop by breeding new hardy and disease-resistant types of citrus fruits.

Procedure.—An attempt is being made to secure and test all kinds of citrus fruits, both wild and cultivated, to determine their value for stocks and breeding purposes. Various types of citrus are crossed to secure hybrids having such special qualities as hardiness, disease resistance, winter dormancy, etc., and these hybrids are propagated as rapidly as possible and distributed for cooperative testing by private growers.

Cooperation.—State experiment stations and private growers in the States mentioned under "Location."

Location.—Citrus-testing stations at Glen St. Mary, Eustis, and Little River, Fla.; Chico and Riverside, Cal.; Tuscaloosa, Ala.; and Eatonton, Ga. General experiments are conducted in cooperation with private growers in Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Oregon, Texas, and Washington.

Date begun.—1897, when first hybrids were made; then the work was temporarily suspended and active experiments under this project not undertaken until 1907.

Results.—The citrange (sweet orange crossed with trifoliate orange) was secured as a result of the first breeding experiments, and is proving useful as a substitute for the lemon for making ade and for general culinary purposes in regions just outside the limits of ordinary orange and lemon culture. The tangelo (grapefruit crossed with tangerine) is a promising sprightly flavored new orange which is being planted to some extent in commercial orchards in Florida. The limequat (West Indian lime crossed with kumquat), one of the newest of the department's citrus creations, yields a fruit resembling the lime in size and flavor, while the tree is much hardier than the lime and also gives evidence of possessing much of the disease resistance of the kumquat.

Assignment.—Walter T. Swingle, Maude Kellerman, E. M. Savage.

Proposed expenditures, 1915–16.—$13,559.

Dry-Land Arboriculture:

Object.—To find deep-rooted and drought-resistant tree crops better adapted for culture in dry-land regions of the United States than the shallow-rooted annual crops now grown.

Dry-Land Arboriculture—Continued.

Procedure.—These investigations are conducted chiefly in cooperation with expert growers in different parts of the dry-land regions of the United States. Laboratory and field experiments are carried on to determine the relative drought resistance and physiological requirements limiting the practical utilization of tree crops in dry-land regions.

Cooperation.—Departmental field stations and private growers.

Location.—Sacaton and Yuma, Ariz.; Indio and Banning, Cal.; Lampasas and San Antonio, Tex.; Fallon and Pyramid Lake, Nev.; and minor experiments with private growers in these States.

Date begun.—1906.

Results.—A number of native species of Prunus have been discovered that seem likely to prove of value for breeding purposes and for use as stocks for our cultivated stone fruits in dry-land regions. One of these, the "wild peach" of Texas yields a small peach-like fruit of excellent quality. A dry-land olive orchard has been established at Sacaton, Ariz., and a test is being made of various types of olives from the Old World.

Assignment.—S. C. Mason.

Proposed expenditures, 1915–16.—$2,740.

Establishment of Pistache Culture:

Object.—To introduce the pistache nut into commercial culture in the United States; to study the life history of the pistache and its wild relatives for the purpose of ascertaining the soil and climatic conditions limiting their successful culture.

Procedure.—A study is made to determine the soil and climatic requirements of wild and cultivated forms of the pistache. Stocks which give promise of proving adapted to this country are imported, propagated, and distributed, to be later budded to the best commercial varieties of the pistache nut.

Cooperation.—Private growers.

Location.—Arizona, California, New Mexico, Texas, and a limited area in Nevada and Utah.

Date begun.—Preliminary studies abroad in 1899; active work under this project inaugurated in 1904.

Results.—Thousands of pistache stocks have been distributed to growers in Arizona, California, New Mexico, Texas, Nevada, and Utah, and as rapidly as these reach the proper size for budding growers are furnished scions of the best commercial varieties of the pistache nut for grafting their stocks. A number of trees in California are now bearing, and the train boys of that State are selling pistache nuts in preference to almonds while the limited supply lasts.

Assignment.—Walter T. Swingle, Maude Kellerman, G. P. Rixford.

Proposed expenditures, 1915–16.—$2,065.

Total, Crop Physiology and Breeding Investigations, $54,780.

[Research.]

SOIL-BACTERIOLOGY INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—To carry on the administrative, clerical, and routine laboratory work necessary for the proper conduct of investigations in soil bacteriology.

Location.—Washington, D. C.

Date begun.—1901.

Assignment.—K. F. Kellerman.

Proposed expenditures, 1915–16.—$5,180.

DISTRIBUTION AND STUDY OF LEGUME BACTERIA.

Demonstration of Inoculation of Legumes:

Object.—To demonstrate the benefit of inoculation of legumes with nitrogen-fixing bacteria by careful field experiments personally supervised.

Procedure.—Field experiments are carried on in cooperation with selected farmers in different regions of the United States and the effect of dif-

Demonstration of Inoculation of Legumes—Continued.

ferent methods of preparing and distributing cultures, as well as different methods of inoculating and cultivating the legume crops, tested on these farms.

Cooperation.—Selected farmers.

Location.—Georgia, Oklahoma, Pennsylvania, and Virginia.

Date begun.—1901.

Results.—Information has been secured which leads to occasional improvements in methods for distributing cultures and for inoculating legumes.

Assignment.—K. F. Kellerman, F. L. Goll, L. T. Leonard.

Proposed expenditures, 1915-16.—$3,340.

Distribution of Cultures for Inoculating Legumes:

Object.—To distribute pure cultures of nitrogen-fixing bacteria for general field tests of inoculating legumes, and to secure reports of results of inoculation from many farmers throughout the various regions of the United States, in order to have some data for comparing the effectiveness of commercial cultures used in similar regions.

Procedure.—Upon request, liquid pure cultures of nitrogen-fixing bacteria are forwarded by mail to planters, who report on the success of the treatment after the crop is harvested.

Location.—Cultures are distributed throughout the United States.

Date begun.—1901.

Results.—The pure-culture method has been proved to be equal in efficiency to inoculation by the use of old field soil, and the quantity and quality of legume crops have been increased and improved throughout the United States.

Assignment.—K. F. Kellerman, L. T. Leonard.

Proposed expenditures, 1915-16.—$10,280.

Inspection of Commercial Cultures:

Object.—To determine whether commercial cultures sold for inoculating legumes are impure, nonviable, or misbranded.

Procedure.—Commercial cultures are purchased in the open market and tested in the laboratory, in the greenhouse, and in the field.

Location.—Washington, D. C.

Date begun.—July 1, 1915.

Assignment—K. F. Kellerman, L. T. Leonard, F. L. Goll.

Proposed expenditures, 1915-16.—$3,000.

Laboratory Investigations of Legume Bacteria:

Object.—To investigate the physiology and life history of strains of *Bacillus radicicola.*

Procedure.—The work includes laboratory and greenhouse studies of methods for stimulating and maintaining the activity of legume bacteria and a determination of the varieties which are susceptible of infecting more than a single host.

Location.—Washington, D. C.

Date begun.—1901.

Results.—Improved methods of propagating and testing cultures have been developed and the character and the proper name of the organism determined.

Probable date of completion.—1917.

Assignment.—K. F. Kellerman, L. T. Leonard.

Proposed expenditures, 1915-16.—$2,000.

Total, Distribution and Study of Legume Bacteria, $18,620.

INVESTIGATIONS IN SOIL BACTERIOLOGY.

Investigations of the Organisms Causing Decomposition of Organic Material in Soils:

Object.—To determine causes of the different kinds of decomposition of organic matter and conditions under which humus is produced in soils.

Procedure.—Laboratory, greenhouse, and field studies of the biological conditions affecting plant growth upon various soils are under way.

Location.—Washington, D. C.

Investigations of the Organisms Causing Decomposition of Organic Material in Soils—Continued.

Date begun.—1909.

Results.—The primary causes of humus formation from carbonaceous material has been determined.

Assignment.—K. F. Kellerman, F. Löhnis, R. C. Wright, F. M. Scales, N. R. Smith.

Proposed expenditures, 1915–16.—$9,250.

Investigations of Nitrifying, Denitrifying, and Nitrogen-Fixing Bacteria:

Object.—To determine the relationships of the organisms which nitrify, denitrify, etc.

Procedure.—Laboratory and field studies in relation to citrus orchards are carried on in order to determine the relationship between the available nitrogen in soil and certain kinds of malnutrition of plants.

Location.—Washington, D. C., and Riverside, Cal.

Date begun.—1912.

Results.—Symptoms of malnutrition of citrus trees developed both from an excessive supply of nitrate in the soil and from an insufficient supply of nitrate have been observed. For orchards showing an excess of nitrates the utilization of small quantities of straw may improve conditions by stimulating the denitrifying bacteria.

Assignment.—K. F. Kellerman, I. G. McBeth, R. C. Wright.

Proposed expenditures, 1915–16.—$4,000.

Total, Investigations in Soil Bacteriology, $13,250.

Total, Soil-Bacteriology Investigations, $37,050.

[Research.]

PLANT-NUTRITION INVESTIGATIONS.

General Investigations in Plant Nutrition:

Object.—To study the growth, development, and composition of plants as affected by nutrition, more particularly the factors of nutrition controlling the quantity of oil produced in important oil-bearing seeds, the functions of the plant-food elements in nutrition, and the relative plant-food requirements of crops commonly grown in rotation.

Procedure.—Laboratory, greenhouse, and field investigations are conducted. In the work on the oil content of seeds, experimental material is grown in field and in greenhouse under controlled conditions of temperature, light, moisture, and food suply, so as to determine the optimum conditions for growing oil-producing plants. In studying relative plant-food requirements, the crop plants are grown on field plats so handled as to insure truly comparable conditions as to food requirements. In all cases the necessary laboratory study of the material is made. Further work on these problems should be continued along substantially the same lines, to give way as completed to other similar problems.

Cooperation.—North Carolina and Maryland experiment stations.

Location.—Upper Marlboro, Md.; Oxford, N. C.; Arlington, Va.; and Washington, D. C.

Date begun.—1906.

Results.—Results covering the more general aspects of the work on the production of oil in seeds, of interest both to farmers and the many industries requiring vegetable oils, have been published (Journal of Agricultural Research, Dec., 1914). It has been shown that the nutrition conditions of the plant play a leading part in oil production in seeds, and during the past year satisfactory data have been obtained on moisture supply and light as factors for optimum oil production. When the work is completed it should be possible to indicate the soil and climatic conditions best adapted to growing oil-producing crops. Good progress has been made in studying the relative plant-food requirements of crop plants under field conditions.

Assignment.—W. W. Garner, H. A. Allard.

Proposed expenditures, 1915–16.—$9.850.

Nutrition of the Date Palm:

Object.—To determine the optimum conditions for the nutrition and fruit production of the date palm, and to develop therefrom a rational system of employing fertilizers in the different date-growing regions.

Procedure.—Laboratory experiments are carried on at Washington; field experiments at Indio and Mecca, Cal., and Tempe, Ariz., examining orchard conditions and establishing rational fertilizer practices for the different regions.

Location.—Washington, D. C.; Indio and Mecca, Cal.; and Tempe, Ariz.

Date begun.—1912.

Results.—In the alkali soils which bake and thereby reduce the productiveness of the date palm the application of numerous small quantities of calcium sulphate improves the texture of the soil and also increases the yield and quality of the date.

Probable date of completion.—1918.

Assignment.—K. F. Kellerman.

Proposed expenditures, 1915–16.—$1,100.

Total, Plant-Nutrition Investigations, $10,950.

[Research.]

SOIL-FERTILITY INVESTIGATIONS.

Maintenance of Soil Fertility:

Object.—To study problems in the management and upbuilding of specific soil types, the best systems of rotation, and the effect of fertilizers. The work will include laboratory investigations on the composition of humus.

Procedure.—Laboratory investigations and field observations.

Location.—Washington, D. C.

Date begun.—About 1904.

Results.—Information disseminated regarding specific soil types and their management; the chemical nature of humus determined and many substances isolated and identified.

Assignment.—Oswald Schreiner, E. C. Shorey, J. J. Skinner, A. Dachnowski.

Proposed expenditures, 1915–16.—$5,296.

Causes of Unproductive Soils:

Object.—To study organic substances causing infertility, such as result in the failure of specific crops, of orchards, in die-back in citrus groves, etc.

Procedure.—Chemical laboratory investigations on soils from unproductive areas.

Cooperation.—Experiment stations and farmers.

Location.—Washington, D. C.

Date begun.—About 1904.

Results.—Several harmful substances isolated and identified.

Assignment.—Oswald Schreiner, E. C. Shorey, E. H. Walters, A. M. Jackson.

Proposed expenditures, 1915–16.—$5,649.

Transformation and Formation of Soil Humus by Biochemical Factors:

Object.—To study changes in soil organic matter and the formation of organic compounds by microorganisms and higher plants.

Procedure.—Biochemical laboratory investigations.

Location.—Washington, D. C.

Date begun.—About 1904.

Results.—Organic chemical compounds have been obtained from molds and soils identical in composition and results applied to formation of humus.

Assignment.—Oswald Schreiner, L. J. Gillespie, F. R. Reid.

Proposed expenditures, 1915–16.—$6,990.

Origin of Organic Constituents in Soils:

Object.—To study the chemical transformation of organic matter in soils, which results in the formation of the constituents isolated from soils.

Procedure.—Biochemical laboratory investigations.

Location.—Washington, D. C.

Date begun.—About 1904.

Results.—Organic matter added to soils has been found to break down along definite lines, yielding compounds some of which had previously been isolated from field soils.

Assignment.—Oswald Schreiner, B. E. Brown, E. C. Lathrop.

Proposed expenditures, 1915–16.—$5,615.

Means for Improvement of Unproductive Soils:

Object.—To determine the fertilizer and lime requirements of soils, the action of compounds isolated from soils, and the effect of fertilizers on these.

Procedure.—Greenhouse and nutrient-solution studies.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—About 1904.

Results.—Information disseminated regarding specific soils and the properties of a considerable number of compounds ascertained.

Assignment.—Oswald Schreiner, J. J. Skinner, A. D. Dachnowski, J. H. Beattie, A. M. Jackson.

Proposed expenditures, 1915–16.—$4,500.

Effect of Fertilizers and Soil Amendments:

Object.—To study the various soil factors as influenced by fertilizers and soil amendments, such as lime, manganese, etc., in the field and with different crops; to study the effect of known organic soil constituents under field conditions and the influence of fertilizers and soil treatments on their action.

Procedure.—Plat and field work.

Cooperation.—Pennsylvania Experiment Station.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—About 1904.

Results.—The effect of many fertilizers and soil amendments on soils ascertained and results published; the effect of soil aldehydes on various crops under field conditions ascertained.

Assignment.—Oswald Schreiner, J. J. Skinner, Henry Winckelmann, F. R. Reid, A. M. Jackson, J. H. Beattie.

Proposed expenditures, 1915–16.—$5,490.

Total, Soil-Fertility Investigations, $33,540.

[Research.]

CROP-ACCLIMATIZATION INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—To provide for clerical and administrative routine, laboratory experiments, and other general details connected with field investigations.

Location.—Washington, D. C.

Date begun.—1905.

Assignment.—O. F. Cook.

Proposed expenditures, 1915–16.—$5,544.

ACCLIMATIZATION, ADAPTATION, AND BREEDING OF COTTON.

Acclimatization of Weevil-Resistant Varieties:

Object.—To secure varieties of cotton resistant to the boll weevil and acclimatize them in the United States.

Procedure.—Varieties with weevil-resistant characters have been discovered in weevil-infested countries of tropical America and acclimatized in the United States. Superior varieties are being bred from these imported stocks and established in cultivation in order to utilize their weevil-resisting characters.

Cooperation.—Individual farmers.

Location.—Mexico, Central America, and the cotton belt of the United States.

Date begun.—1905.

Results.—Durango, Acala, Kekchi, and Tuxtla cottons have proved to be unusually early and consequently of great value in weevil-infested regions. Aside from being early, these varieties produce lint of exceptional quality. The lint from Tuxtla selections made at Boerne, Tex., was 1$\frac{3}{16}$ inches long, and the bolls averaged 40 to the pound, compared with 50 and 60 of common varieties of this length.

Assignment.—O. F. Cook.

Proposed expenditures, 1915–16.—$6.417.

Cultural Factors Under Weevil Conditions:

Object.—To secure information concerning the local modifications of cultural methods necessitated by the presence of the boll weevil.

Procedure.—The factors that determine the production of cotton under weevil conditions are being studied by means of experiments with different methods of planting, thinning, and cultivation to learn how the behavior of the plants can be controlled so as to induce earlier fruiting and thus avoid injury from the boll weevil.

Cooperation.—Individual farmers; and Office of Extension Work in the South, States Relations Service.

Location.—That part of the cotton belt infested by the boll weevil.

Date begun.—1905.

Results.—The new single-stalk system of cotton culture developed by this office has been found to be especially adapted to regions infested by boll weevils. In 1914 single-stalk culture yielded from 20 to 100 per cent more seed cotton per acre than the common methods, and in each case an earlier crop was produced. The principles of single-stalk culture have been explained in a number of publications.

Assignment.—O. F. Cook.

Proposed expenditures, 1915–16.—$5,133.

Cultural Factors in Arid Regions:

Object.—To study varieties of cotton and methods of culture with reference to drought and to extend cotton growing beyond the supposed limits of the cotton belt.

Procedure.—Cultural factors in arid regions are studied by testing differences of drought resistance under field conditions and determining the special characters to which the unusual drought resistance of the Central American varieties is due.

Cooperation.—Individual farmers.

Location.—Arizona, California, and Texas.

Date begun.—1906.

Results.—Durango cotton, acclimatized from Mexico, has shown distinct advantages over other long-staple Upland varieties in drought resistance as well as in adaptation to irrigation culture. It is now being grown extensively in the Imperial Valley of California. In the Imperial Valley and in the Salt River Valley of Arizona, where the Egyptian cotton-growing industry is becoming well established, single-stalk culture has yielded about 25 per cent more seed cotton per acre than the old systems.

Assignment.—O. F. Cook.

Proposed expenditures, 1915–16.—$1,283

Local Adjustment and Adaptation of Varieties:

Object.—To ascertain the factors of local adjustment, determine the range of environmental adaptations of varieties and the best varieties for particular local conditions, and to avoid the present wasteful multiplicity of varieties by proper methods of standardization.

Procedure.—Local adjustment and adaptation of varieties are investigated by testing the same varieties and stocks of cotton in different regions to ascertain how far the same variety can be adapted to different conditions, and thus determine the extent to which it is possible to grow the same varieties in different parts of the cotton belt.

Cooperation.—Individual farmers.

Location.—Cotton belt of the United States.

Date begun.—1909.

Results.—Durango cotton has been found to be adapted to conditions in the Southwestern States, South Carolina, Virginia, Alabama, and northern Oklahoma, thus affording a striking illustration of adaptability to a wide range of natural conditions. Marked adaptability is being exhibited also by other acclimatized varieties, namely: Acala in Oklahoma, Kekchi in Tennessee, and Tuxtla in Texas and South Carolina. The production of these varieties is being extended.

Assignment.—O. F. Cook.

Proposed expenditures, 1915–16.—$2,567.

Breeding and Preservation of Varieties:

Object.—To determine general factors of improvement and deterioration of varieties, including selection, cultural methods, variety testing, etc.

Procedure.—Improved methods of selection have been developed and are being applied to the preservation of superior varieties from deterioration. The need of growing varieties separately in the fields and avoiding the admixture of seed at gins is being impressed upon the cotton-growing public, as well as the desirability of each community limiting itself to a single variety of cotton.

Cooperation.—Individual farmers.

Location.—Cotton belt of the United States.

Date begun.—1909.

Results.—Continued distribution of pure seed of superior varieties is necessary in order to allow them to be established in cultivation. It is necessary, also, to keep such seed from deterioration by preserving its purity, and to do this certain precautions on the part of the farmers are necessary. These precautions are explained in a circular which accompanies the seed distributed. The following varieties bred by this department were distributed in 1915; Lone Star, Trice, Columbia, Durango, Holdon, and Foster. The other varieties being bred and tested will not be distributed unless they show distinct superiority over those already in cultivation.

Assignment.—O. F. Cook.

Proposed expenditures, 1915–16.—$10,266.

Total, Acclimatization, Adaptation, and Breeding of Cotton, $25,666.

ACCLIMATIZATION, ADAPTATION, AND EXTENSION OF CORN.

Acclimatization, Adaptation, and Extension of Corn:

Object.—To secure varieties of corn adapted to conditions in our tropical territory and the United States, particularly in the subtropical Gulf region and the arid West; to devise a practicable method of utilizing the increased yield and vigor of corn hybrids.

Procedure.—Ascertain the adaptive characters and habits of varieties of corn; visit corn-growing districts in tropical America and study local varieties, factors, cultural conditions, and uses; combine through hybridization the desirable characteristics possessed by different varieties.

Cooperation.—Individual farmers and the California Experiment Station at Berkeley.

Location.—Central America, South America, Mexico, and the tropical, subtropical, and arid regions of the United States.

Date begun.—1905.

Results.—A new type of waxy corn from China has been found to be adapted to the dry regions of Texas. A more accurate method of comparing the yields of first-generation hybrids has been devised.

Assignment.—G. N. Collins.

Proposed expenditures, 1915–16.—$6,800.

ACCLIMATIZATION AND ADAPTATION OF TROPICAL PLANTS.

Acclimatization and Adaptation of Tropical Plants:

Object.—Acclimatization and adaptation of superior varieties of coffee, banana, cacao, rubber, coconut and other palms, and other tropical plants in the United States, and the improvement of cultural and breeding methods as applied to such plants.

Procedure.—The habits of superior varieties of tropical plants encountered during our foreign explorations for cotton and corn are studied, and information gained in this way is used to assist acclimatization experiments in the United States and for the general information of the public regarding the agricultural status and production of the various tropical crops. These investigations are conducted at small expense, advantage being taken of the opportunities afforded by the explorations that are necessary in connection with the cotton and corn work. An expedition to Peru, now in progress in cooperation with the Yale University and the National Geographic Society, is expected to afford opportunity for securing agricultural and botanical information regarding the species

Acclimatization and Adaptation of Tropical Plants—Continued.
and varieties of cotton, corn, and other cultivated plants, the adaptive characters and uses of such plants, and their suitability for cultivation in the United States.
Cooperation.—Private growers, nursery farms, and park authorities.
Location.—Washington, D. C.; Southern and Southwestern States; and the tropical and subtropical possessions of the United States.
Date begun.—1909.
Results.—An expedition into the plateau region of Guatemala has resulted in the introduction of hardy varieties of avocados especially adapted for shipping and which mature in the fall, winter, and spring instead of the summer. New kinds of palms adapted to open-air planting in the South and West were also introduced.
Assignment.—O. F. Cook.
Proposed expenditures, 1915–16.—$3,850.

Total, Crop-Acclimatization Investigations, $41,860.

[Research.]

DRUG-PLANT, POISONOUS-PLANT, PHYSIOLOGICAL, AND FERMENTATION INVESTIGATIONS.

SUPERVISION.

Supervision:
Object.—To provide supervision, clerical assistance, and miscellaneous supervisory and administrative needs of the projects of the group.
Location.—Washington, D. C.
Date begun.—1902.
Assignment.—R. H. True, W. W. Stockberger.
Proposed expenditures, 1915–16.—$11,100.

DRUG AND RELATED PLANTS AND THEIR PRODUCTS.

Establishment of the Camphor Industry:
Object.—The introduction of an industry in the production of camphor in this country.
Procedure.—Field and laboratory experiments, including tests of camphor content and distribution in grown trees, the experimental propagation, cultivation, and selection of the plants, and the working out of the best methods of growing the camphor tree and utilizing the product.
Cooperation.—Land and buildings furnished by the Orange County (Fla.) Fair Association.
Location.—Orlando, Fla.
Date begun.—1908.
Results.—As a direct outcome of the department's work on camphor, several large commercial enterprises have been undertaken. One company, which has a planting of 1,000 acres, produced 10,000 pounds of crude camphor last year; others are beginning operations which will increase the total camphor area to 8,000 acres.
Probable date of completion.—1918.
Assignment.—S. C. Hood.
Proposed expenditures, 1915–16.—$1,810.

Red-Pepper and Tea Cultivation:
Object.—The introduction of an industry in the cultivation and manufacture of American tea and in the culture of red peppers for the spice market.
Procedure.—Cultural field studies supplemented by factory experiments in making and preparing tea for market; cultural tests of red-pepper varieties with reference to yield, disease resistance, quality of product, etc.; and experiments dealing with the special methods required in growing and handling the crops.
Cooperation.—Dr. Charles U. Shepard, of Summerville, S. C., furnishes the land, crop, and factory for tea experiments; red-pepper experiments made in cooperation with practical farmers.
Location.—South Carolina.
Date begun.—1902.

Red Pepper and Tea Cultivation—Continued.

Results.—American tea now produced and successfully marketed; the successful introduction of paprika culture indicates the possibility of the profitable introduction of the hotter cayenne varieties of red pepper.

Probable date of completion.—Tea experiments practically complete, except for miscellaneous investigations of minor importance; red-pepper experiments will probably be completed in 1917.

Assignment.—W. W. Stockberger, T. B. Young.

Proposed expenditures, 1915–16.—$2,520.

Hop Improvement on the Pacific Coast and in New York:

Object.—Improvement of methods of growing, curing, handling, and standardizing American hops.

Procedure.—The work includes a physiological study of the root disease of hops, study of the influence of various fertilizers on yield and quality, development of hybrids with German varieties, and study of cost of production in relation to the present method of handling the crop; also study of the chemical constituents which determine the value of hops.

Cooperation.—Land and crop facilities are furnished by hop growers.

Location.—Headquarters at Perkins, Cal.; also test of area under special handling in Oregon, and field investigations throughout the hop-growing regions of the Pacific Coast States and New York.

Date begun.—1905.

Results.—The hop-improvement studies have made it possible to outline practical modifications in field methods, resulting in substantial gains in production, while progress in the determination of more rational and uniform standards of hop valuation has resulted from the laboratory study of hop constituents.

Assignment.—W. W. Stockberger, James Thompson.

Proposed expenditures, 1915–16.—$4,000.

Vegetable-Oil Crops and Their Products:

Object.—To study American-grown plants yielding oils, with reference to the utilization of their products.

Procedure.—Cultivation of oil-yielding crops at testing stations and by private cooperators; also study of the by-products of the fruit and canning industry and of other plant sources of fixed or volatile oils. Laboratory tests are made of the quality, quantity, and constituents of the oils with reference to their technical value. Actual tests of the products of the experiments in cooperation with manufacturers using these or similar products are under way.

Location.—Washington, D. C.; crop facilities furnished by the testing gardens at Arlington, Va., Glenn Dale, Md., and Madison, Wis.

Date begun.—1906.

Results.—Discovery of new sources of thymol in species of Monarda (horsemint); of limonene, a turpentine substitute, in the common fireweed; of a substitute for linseed oil in raisin waste; and a demonstration of value in peach, apricot, and prune kernels.

Assignment.—Frank Rabak.

Proposed expenditures, 1915–16.—$2,440.

Miscellaneous Field and Laboratory Work on Drug and Related Plants:

Object.—To test in experimental field cultures numerous drug and related plants not covered by other projects, and to investigate their products in the laboratory with reference to their value and utilization. This project covers a large number of preliminary investigations and minor problems, including a study of small experimental cultures of a large number of drug and related plants, and miscellaneous pharmaceutical laboratory studies dealing with the value and utilization of the products.

Procedure.—(1) Small experimental cultures of drug and related plants at testing stations. In general, these tests comprise preliminary trials, which require careful attention in the field and collaboration with laboratory assistants. (2) The working out of a variety of laboratory problems not having project rank, such as the relation of special feeding to the development of active principles in medicinal plants, and numerous other technical studies of drug and related plants.

Miscellaneous Field and Laboratory Work on Drug and Related Plants—Con.

Cooperation.—University of Wisconsin, at Madison, Wis.; Omro Drug Plant Co., at Omro, Wis.; R. S. Hepburn, Timmonsville, S. C.; Orange County Fair Association, Orlando, Fla.

Location.—Washington, D. C.; Arlington, Va.; Glenn Dale, Md.; Timmonsville, S. C.; Madison and Omro, Wis.; and Orlando, Fla.

Date begun.—1902.

Results.—About 150 species of drug and related plants are under experimetal culture on the heavy clay at Arlington Farm and on sandy loam near Glenn Dale, Md. As a feature of the work at Arlington permanent plantings are being made, which will furnish greatly needed authentic material for standardizing crude drugs. At Glenn Dale the adaptability of sandy loam has been satisfactorily tested and plantings made on a scale sufficiently large to afford data of commercial value. At Madison, Wis., various drug and related plants tested under the conditions found in the upper Mississippi Valley have yielded results which form the basis this year of crop tests at Omro under actual conditions of crop production. Experiments in the improvement of the drug belladonna through breeding and selection have yielded a strain of greatly increased alkaloidal content and point the way to a very great improvement in the quality of this drug as at present found on the market. In crop tests in South Carolina a very favorable showing has been made by the drug *Cannabis indica.*

Assignment.—W. W. Stockberger, W. Van Fleet, S. C. Hood, Thomas B. Young, A. F. Sievers, G. A. Russell.

Proposed expenditures, 1915–16.—$11,284.

Total, Drug and Related Plants and Their Products, $22,054.

POISONOUS-PLANT INVESTIGATIONS.

Geographical Distribution and Localization of Poisonous Plants:

Object.—To study the geographical distribution and localization of poisonous plants, with special reference to those areas in which, owing to their abundance or concentration, they are believed to be especially harmful.

Procedure.—Botanical reconnoissances in areas where harmful plants are believed to be present, the collection of suspected plants for identification, and the plotting of the distribution and abundance of those believed to be poisonous.

Cooperation.—Bureau of Animal Industry.

Location.—Washington, D. C., and various other points.

Date begun.—1915.

Assignment.—W. W. Stockberger, W. W. Eggleston.

Proposed expenditures, 1915–16.—$2,300.

Miscellaneous Studies of Poisonous Plants:

Object.—To study poisonous plants with respect to their constituents, methods or eradication and means of avoiding plants harmful to man, etc.

Procedure.—Field and laboratory studies of suspected plants.

Location.—Washington, D. C.

Date begun.—1915.

Assignment.—W. W. Stockberger.

Proposed expenditures, 1915–16.—$200.

Total, Poisonous-Plant Investigations, $2,500.

INVESTIGATIONS IN PLANT PHYSIOLOGY AND FERMENTATION.

Physiological Action of Solutions of Organic and of Inorganic Substances on Crop Plants:

Object.—To ascertain the fundamental requirements made by plants upon the medium in which they live.

Procedure.—Study of the function and growth of crop plants in water cultures and sand cultures made up with mixed solutions of organic and inorganic materials, the action of which on plant growth is to be de-

Physiological Action of Solutions of Organic and of Inorganic Substances on Crop Plants—Continued.

termined. The work is carried on under carefully controlled physiological conditions through the use of laboratory and greenhouse methods.

Location.—Washington, D. C.

Date begun.—1908.

Results.—Work on the chemical requirements of plants has shown: (1) That distilled water and solutions lacking calcium cause a loss of salts by plants, absorption not being sufficient to equal this loss. When the necessary amount of calcium is added, absorption is rapid and salts already in the plant are retained. (2) The soil solution in order to support normal life must contain in proper proportions certain well-known inorganic salts characteristic of fertilizers. When the proper balance is not found in the soil solution the plant behaves abnormally or dies. Results published in B. P. I. Bulletin 231 and in technical papers disseminated through scientific periodicals.

Assignment.—R. H. True, H. H. Bartlett.

Proposed expenditures, 1915–16.—$2,885.

Physiological Study of the Effects of Storage on Fruits and Vegetables:

Object.—To study the physiological behavior of sweet potatoes, onions, and other vegetables, also fruits, during storage under various conditions, with the view of determining the reason for physiological weaknesses developed during and after storage.

Procedure.—Storage of vegetables and fruits at various temperatures for various lengths of time, accompanied by biochemical and physiological study of samples of the material taken at different stages of the experiments, in the hope of learning what changes take place during storage and with what result. These investigations are supplemented by field observation and microscopic study.

Location.—Washington, D. C.

Date begun.—1909.

Results.—An elaborate study of the physiological changes taking place in the sweet potato before and during storage has shown that in response to low storage temperatures sweet potatoes undergo profound modification of their reserve materials, and that this is accompanied by an increased susceptibility to infection from organisms producing decay. This breakdown can be postponed by storage at high temperatures. Results published in Journal of Agricultural Research, vol. 3, No. 4. Respiration studies not yet finished deal with other physiological features characteristic of different storage temperatures.

Assignment.—H. Hasselbring.

Proposed expenditures, 1915–16.—$3,140.

Physiological Study of the Relation of Oxidizing Enzyms to Plant Diseases:

Object.—To devise a practical method of ascertaining variation in oxidase content in normal and diseased plants, and to investigate the relation of oxidase action to certain important plant diseases.

Procedure.—By devising methods and apparatus for determining oxidase action; and the investigation in field and laboratory, by means of these methods, of oxidase action in normal and diseased plants.

Location.—Washington, D. C.

Date begun.—1909.

Results.—This work has led to the development of a new and very useful method of measuring oxidase action, making it possible to investigate the significance of the oxidase enzyms in normal and diseased plants. These diseases fall into two classes: (1) Those in which an increased oxidizing capacity is present, suggesting a condition comparable to fever in animals; (2) diseases in which no such increase is seen. The bearing of these differences on plant metabolism is the next study to be undertaken. Results published in B. P. I. Bulletins 238 and 277; Journal of Agricultural Research, vol. 2, No. 5; and technical papers in scientific periodicals.

Probable date of completion.—1917.

Assignment.—H. H. Bunzell.

Proposed expenditures, 1915–16.—$2,440.

Physiological Study of Molds and Parasitic Fungi and Their Relation to the Deterioration of Plant Products:

Object.—To investigate the physiology of molds and parasitic fungi with special reference to the products of their metabolism, with a view to determining their conditions of life and the nature and effect of the products which they elaborate.

Procedure.—Cultivation of molds and other organisms concerned in the deterioration of seeds, fruits, grains, and other plant products, in pure cultures and in culture media composed of these plant products; study of the products of the activity of these organisms with reference to their chemical and physiological properties, possible toxicity, etc.; study of plant products from ordinary sources with reference to the presence of these substances.

Location.—Washington, D. C.

Date begun.—1909.

Results.—Method of determining the degree of deterioration in corn by the acidity test devised and now generally adopted by health boards, corporations, and by the Office of Grain Standardization of the Bureau of Plant Industry. The action of molds growing on spoiled corn has been studied with special reference to the development of toxic substances, and a toxic product has been isolated from cultures of *Penicillium puberulum*. Results published in B. P. I. Bulletins 199 and 270. It has been shown that parasitic fungi utilize certain constituents of their host plants, while other constituents of the host are apparently not affected, and studies have been undertaken to ascertain the mode of attack of various fungi. The results of a study of the effect of the peach brown-rot fungus on constituents in peach fruit have been reported, and a paper dealing with the method of attack of the fungus producing bitter-rot in the apple has been submitted for publication.

Probable date of completion.—1917.

Assignment.—O. F. Black, Lon A. Hawkins.

Proposed expenditures, 1915–16.—$5,440.

Physiological Study of Germination:

Object.—To investigate the fundamental physiology of the germination of seeds, tubers, and other reproductive plant structures.

Procedure.—Study of seeds, bulbs, tubers, etc., before, during, and after germination under various chemical and physical conditions under careful laboratory control; analyses of these structures to ascertain the movement of contained substances; tests of enzym activities in seeds and seedlings.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Organization of experiments in progress.

Assignment.—R. H. True.

Proposed expenditures, 1915–16.—$2,000.

Physiological Study of the Chestnut Tree in Its Relation to Chestnut Blight:

Object.—To determine changes produced in the metabolism and chemical behavior of the chestnut tree by the presence of the chestnut-blight organism in the hope of finding means of attacking the organism.

Procedure.—Physiological and biochemical study of the characteristics of normal and infected trees.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1917.

Assignment.—S. L. Jodidi.

Proposed expenditures, 1915–16.—$3,750.

Miscellaneous Investigations in Plant Physiology and Fermentation:

Object.—To handle miscellaneous minor problems arising in the conduct of general plant physiological and fermentation investigations.

Procedure.—Investigations in laboratory, field, and greenhouse carried on by specialists using technical methods. Preliminary investigations conducted here lead to submittal of definite projects where the problems concerned prove to be of project rank.

Location.—Washington, D. C.

Date begun.—1909.

Miscellaneous Investigations in Plant Physiology and Fermentation—Contd.

Results.—Studies of heredity and variations have yielded light on principles governing the origin of new forms and species in the genus Oenothera and seem to confirm the existence of the process of mutation as contended by De Vries; results published in a series of articles. Work on the constituents of poisonous plants has resulted in the isolation of several alkaloids poisonous to stock from species of lupine; also the discovery of a toxic principle in Eupatorium. A method of fumigating seed has been devised in cooperation with the Federal Horticultural Board, and published in Department Bulletin 186. Other miscellaneous publications deal with the prevention of molds on cigars, Department Bulletin 109, and the manufacture of agricultural alcohol in Germany, Department Bulletin 182.

Assignment.—R. H. True, H. H. Bartlett, O. F. Black.

Proposed expenditures, 1915–16.—$4,871.

Total, Investigations in Plant Physiology and Fermentation, $24,526.

Total, Drug-Plant, Poisonous-Plant, Physiological, and Fermentation Investigations, $60,180.

[Research.]

AGRICULTURAL TECHNOLOGY INVESTIGATIONS.

Supervision:

Object.—To conduct administrative work, including clerical routine and laboratory duties.

Location.—Washington, D. C.

Date begun.—1907.

Assignment.—N. A. Cobb, W. E. Chambers, Albert Mann.

Proposed expenditures, 1915–16.—$6,620.

Free-Living and Plant-Infesting Nematodes:

Object.—To improve the methods of treating crops so as to diminish the losses due to attacks of nematodes, including the technological study of the nematodes themselves, their species, life history, and general economic relationships.

Procedure.—This project involves a study of the nature, distribution, and economic relationship of nematodes parasitic in plants. The soil-inhabiting nematodes, not necessarily parasitic, are eminently adapted to the production of small wounds in the roots of plants, where microbes and fungi may afterwards find an entrance. It is proposed to apply present knowledge of these nematodes to the study of their attacks on plants, with the object of lessening the damage caused thereby.

Cooperation.—Individual growers in various States, other officers of the department and other branches of the Government, universities, and State governments.

Location.—Washington, D. C.; practically every State.

Date begun.—1906.

Results.—Drawings of about 60 species of spear-bearing nematodes, of which fully five-sixths are species of Dorylaimus—all of them, so far as we now know, more or less injurious to plants—have been prepared for publication. Additional information with regard to the structure and life history of the root-gall nematode has been obtained. Studies of foreign soils likely to be imported into the country have been continued, particularly the soils of Brazil. It has been established that rhabditin resembles starch and hæmoglobin in being specific in its properties for each species of nematode. An article entitled "Nematodes and Their Relationships" appeared in the Department Yearbook for 1914. Researches which have been conducted relative to the physiology of certain genera of nematodes common in soil are leading to interesting discoveries not unlikely to have a connection with soil fertility. It has been discovered that nematodes are much more abundant in trees than has been supposed. Examinations have been made of dasheen corms in connection with the Office of Foreign Seed and Plant Introduction, with a view to diminishing the nematodes infesting them, that they may be safely distributed for growth. It has been found that nematodes are being introduced on imported beet seed. A special report on the species

Free-Living and Plant-Infesting Nematodes—Continued.

Tylenchus biformis, which has been found attacking sugar cane in Hawaii and Jamaica, is being prepared, as recent observations lead to the conclusion that this parasite is more dangerous than formerly supposed. The *Tylenchus devastatrix* has been noted in new localities and steps have been taken to warn the public of its spread. An article has been prepared on *Tylenchus semipenetrans* and published. A number of articles have been published in scientific journals, all of which have a more or less distinct economic bearing.

Assignment.—N. A. Cobb, W. E. Chambers.

Proposed expenditures, 1915–16.—$4,300.

Fiber Technology:

Object.—The study of fiber, especially cotton fiber, with a view to increasing our knowledge of the properties of the fiber from a technological standpoint. The work on cotton fibers will have special reference to length, diameter, texture, roughness, color, etc.

Procedure.—Laboratory studies of fiber characters will be carried on.

Cooperation.—Government agencies, both State and Federal; growers and manufacturers.

Location.—Washington, D. C.

Date begun.—1915, as a separate project; studies along these lines have been in progress for some years in connection with work upon cotton standardization.

Results.—Attention is called to the development of vacuum storage, improvements in the preparation of cotton grades, as (*a*) the introduction of a photographic record of the appearance of cotton when issued as a standard; (*b*) the improved methods of storing the types in the grade boxes so that their condition approaches more nearly to a standard than has been the case in the past, i. e., placing the types in cartons by which they retain their form and size, the fastening of the cartons in position, the standard compression of the types, and the holding of the upper surface of the types below the lid of the container, so that they are not subjected to pressure; and (*c*) the application of vacuum storage to the preservation of the fugitive tints characteristic of tinged and stained cotton.

Assignment.—N. A. Cobb.

Proposed expenditures, 1915–16.—$8,120.

Laboratory and Field Equipment:

Object.—To investigate and improve laboratory and field equipment with a view to improved efficiency, and to study and devise projection apparatus for making magnifications of microscopic objects and for improving illustrations and making minute measurements.

Procedure.—Devising new apparatus that shall be more efficient, and making such experiments as are suggested by the exigencies of this office as well as of other offices.

Cooperation.—Individual farmers and experts in various States, Government officials, and manufacturers.

Location.—Washington, D. C.

Date begun.—1907.

Results.—A clover-seed harvester has been devised and put into operation in conjunction with the Office of Forage-Crop Investigations. A machine for trimming bulbs has been invented, patented, and put into successful operation. Designs for a cotton drier have been prepared in part. A good deal of work has been done in modifying the various instruments and machines used in spinning work so as to make them more accurate and better adapted to experimental work. Improvements have been made in various apparatus used in agricultural research, such as cameras, microscopic apparatus, photostats, projectors, differentiators, and objectives. Improvements have been made in the fiber-breaking machine used by the department, and a new device has been evolved for securing end views of small microscopic objects. Considerable study and experimental work with regard to cotton ginning and its effect on cotton have been undertaken, resulting in some instances in putting into practical effect the ideas that have been thus developed. To a smaller extent this is also true of cotton pickers and cotton presses. Study is being given to the

Laboratory and Field Equipment—Continued.

possibility of making an accessory to the mowing-machine cutter which will assist in the harvesting of bur-clover seed.

Assignment.—N. A. Cobb.

Proposed expenditures, 1915–16.—$2,380.

Total, Agricultural Technology Investigations, $21,420.

[Research.]

FIBER-PLANT INVESTIGATIONS.

Sisal, Henequen, and Allied Plants:

Object.—Increased cultivation of sisal under conditions favorable for the industry in Hawaii; determination whether other similar plants may be profitably cultivated for fiber production in Hawaii or in Porto Rico.

Procedure.—Information about fiber-producing agaves and furcræas is secured and, if promising, plants are obtained and tried at the experiment station in Porto Rico or by the Hawaiian Sisal Co. in Hawaii. Suggestions for improving sisal plants in Hawaii, also information as to the market and the preparation of the fiber to meet the demands of the market, are given to the Hawaiian Sisal Co. Information is obtained from all available sources regarding plants producing fiber suitable for binder twine. Inquiries of would-be investors, inspired by promoters, are answered, warning against attempts to cultivate unprofitable plants or good plants under impossible conditions.

Cooperation.—Porto Rico Experiment Station, Mayaguez, P. R.; Hawaiian Sisal Co. (Ltd.), Honolulu, Hawaii.

Location.—Washington, D. C.; Mayaguez and Yauco, Porto Rico; Sisal and Robinson, Hawaii.

Date begun.—1902.

Results.—Fourteen introductions, including 10 different species, some of them in quantity, have been made into Porto Rico. It is found that the true sisal plant grows best in Porto Rico, but there is not a sufficient area of land suitable for this plant available there under present conditions at a cost which will permit the industry to be profitably carried on. Several agaves and furcræas have been introduced into Hawaii, but they have not grown as well as sisal. Fiber of better quality is being produced in Hawaii, and the development of improved types of sisal plants is under way. Conditions in Florida and southern Texas are found unfavorable for the cultivation of these fiber plants.

Assignment.—Lyster H. Dewey.

Proposed expenditures, 1915–16.—$300.

Flax Fiber Production:

Object.—To encourage the production of flax fiber in regions adapted to the crop in this country to meet the increasing demand, and to prevent a waste of capital in impractical schemes; to bring about production in the United States of supplies of seed of fiber types of flax.

Procedure.—Determining by investigation the types of flax fiber desired by American spinners; then developing, by means of plant breeding, flax plants yielding these desirable types, and trying them out in cooperation with practical flax growers; disseminating by correspondence and bulletins information regarding the requirements, processes, cost, and probable profits in the cultivation of flax. Flax-breeding work is being carried on in Michigan, together with seed-increase plantings of the most promising types and cooperative experiments with fertilizers for fiber flax. Fiber types of flax seed are being grown at the Minnesota Northwest Experiment Station, Crookston, Minn., to demonstrate that seed of fiber flax may be produced in this country without deterioration.

Cooperation.—James Livingston Flax Co. (Ltd.), Yale, Mich.; Minnesota Experiment Station, Northwest School and Station, Crookston, Minn.; Summers Linen Co., Port Huron, Mich.

Location.—Washington, D. C.; Crookston, Minn.; Croswell and Yale, Mich.

Results.—Experiments at Crookston indicate that, contrary to the generally accepted theory, seed of fiber flax may be produced in this country fully equal to that imported. Several improved strains of fiber have been developed.

Assignment.—Lyster H. Dewey, Frank C. Miles.

Proposed expenditure, 1915–16.—$2,980.

Hemp Fiber Production:

Object.—To encourage the production of hemp fiber in the United States in regions where the hemp crop promises as good profits as may be obtained from other crops; to promote the production of seed of improved varieties of hemp.

Procedure.—Improved types of hemp are being developed by plant breeding. Seed of these improved types is distributed to commercial hemp-seed growers. Methods of preparing hemp fiber are investigated. Cooperative demonstration work with the Wisconsin Experiment Station was carried on, resulting in the establishment of hemp growing in that State. Similar work is contemplated in other States. Information regarding the best methods of handling the crop is secured and disseminated. Work is being continued along the lines mentioned, and an increased area at the Arlington (Va.) and Yarrow (Md.) farms is being devoted to the production of seed of improved varieties.

Cooperation.—J. L. Andreas, Pierceton, Ind.; Kentucky and Wisconsin experiment stations.

Location.—Lexington, Ky.; Madison, Wis.; Pierceton, Ind.; Washington, D. C.

Date begun.—1902.

Results.—Hemp-growing industry established on a commercial basis in Wisconsin; industry encouraged and aided in Indiana and Ohio; more than 1,200 bushels of seed produced by one hemp-seed grower in Kentucky last season from the second generation of seed of an improved strain sent to him from the Office of Fiber-Plant Investigations in the spring of 1913, a large proportion of the entire hemp-seed crop of 1915 being planted with seed of this improved variety, which is recognized as markedly superior to the ordinary unselected Kentucky hemp; experiments in cooperation with the Indiana Experiment Station in 1914 showed that the application of potash on muck soils produced an increased growth of plants and larger yield of fiber, while lime and phosphoric acid failed to indicate any marked improvement.

Assignment.—Lyster H. Dewey, Frank C. Miles.

Proposed expenditures, 1915–16.—$3,160.

Ramie Fiber Production:

Object.—To determine whether ramie may be grown successfully and profitably in the United States or its island possessions; to investigate methods of handling the crop and preparing the fiber; to encourage its cultivation, if it can be profitably grown; and to discourage waste of capital in stock-selling schemes or attempts to produce ramie under conditions that have been proved to be impossible.

Procedure.—Information is secured and verified, so far as possible, regarding the cultivation of ramie and the production of the fiber. Small plats are grown for observation, and roots for propagation are furnished to experimenters. One highly recommended decorticating machine has been tried on a scale sufficient to give definite results. Since the results thus far obtained are negative, this subproject will be held in abeyance until a more promising method of decortication is discovered. Meanwhile, investigations confined chiefly to correspondence will be continued, in order to secure all available information.

Location.—Washington, D. C.

Date begun.—1890.

Results.—Definite data secured regarding the yield of fiber and the impractical character of decorticating machines thus far devised; many false statements of enthusiastic promoters controverted and would-be investors saved from wasting money.

Assignment.—Lyster H. Dewey.

Proposed expenditure, 1915–16.—$160.

Miscellaneous Fiber Investigations:

Object.—To collect, record, and disseminate information about all kinds of plants, except cotton, producing textile, stuffing, or coarse weaving fibers; to identify fiber plants and plant fibers; to conduct experiments in cultivating some of the most promising fiber plants.

Procedure.—Information is secured from literature, periodicals, correspondence, and personal observation, and filed for ready reference. Some of the more promising plants are being grown at Arlington Farm.

Miscellaneous Fiber Investigations—Continued.

Location.—Washington, D. C.

Date begun.—1890.

Results.—More than 2,000 letters asking about fiber plants of minor importance answered each year: more information about fiber plants on file than anywhere else in the world.

Assignment.—Lyster H. Dewey.

Proposed expenditures, 1915–16.—$2,230.

Total, Fiber-Plant Investigations, $8,830.

[Research.]

GRAIN-STANDARDIZATION INVESTIGATIONS.

Supervision:

Object.—The direction and supervision of all investigations relating to the handling, grading, and transportation of grain and flax seed and the fixing of definite grades thereof.

Cooperation.—Various grain exchanges and grain-trade organizations, Bureaus of Chemistry and Animal Industry, War Department, and the State experiment stations.

Location.—Washington, D. C.; headquarters of laboratories outside of Washington at Baltimore, Md., Chicago, Ill., Decatur, Ill., Fargo, N. Dak., Kansas City, Mo., New Orleans, La., and Portland, Oreg.

Date begun.—1906.

Assignment.—J. W. T. Duvel, E. G. Boerner.

Proposed expenditures, 1915–16.—$14,160.

Establishment of Definite Grain Grades on the Basis of Intrinsic Value:

Object.—To determine the relative value of important factors which enter into the commercial grading of grain, and to formulate rules and specifications for standardizing grades so that the requirements of the different grades will be in keeping with their intrinsic values.

Procedure.—Consists mainly in the correlation of various data secured under the projects which follow, and studying the conditions that exist in the grain trade so that grades may be established on a basis that will not seriously interfere with legitimate commercial practices.

Cooperation.—Grain producers, country shippers, grain exchanges, grain-inspection departments, manufacturers of grain products, and various national and State grain-trade organizations.

Location.—Washington, D. C., and grain markets and ports of the United States.

Date begun.—1907.

Results.—Grades for corn have already been established, which grades have been adopted by the grain-inspection departments of most of the important markets. Investigations leading to the fixing of grades for other grains, especially wheat and oats, are being pushed as rapidly as funds will permit.

Assignment.—J. W. T. Duvel, E. G. Boerner.

Proposed expenditures, 1915–16.—$12,320.

Effect on Grade and Commercial Value of Farm Methods of Harvesting and Handling Grains:

Object.—To show how different methods of harvesting, handling, and storing on the farm affect the commercial grade and value of the grain when sold, with a view to pointing out to producers how present methods can be improved.

Procedure.—Samples of grain are secured as harvested under different conditions and at different stages of maturity and when stored in different types of granaries and cribs. Such samples are graded by expert graders and the values ascertained through dealers or manufacturers making a speciality of the kind of grain under consideration.

Cooperation.—Grain growers, dealers, and manufacturers of grain products.

Location.—Washington, D. C., and the grain-growing sections of the United States, including the rice areas of the South.

Date begun.—1907.

Results.—Improved methods of harvesting, shocking, stacking, and thrashing small grain and the harvesting and cribbing of corn have been

Effect on Grade and Commercial Value of Farm Methods of Harvesting and Handling Grains—Continued.

demonstrated. For example, grain when properly stacked yields a higher quality than when thrashed from the shocks. Likewise, corn stored in large cribs does not dry out readily, and cribs built north and south turn out a better quality of corn, when it is shelled in the summer following harvest, than cribs built east and west.

Assignment.—J. W. T. Duvel, E. L. Morris, C. A. Russell, Philip Rothrock, F. B. Wise, L. M. Jeffers.

Proposed expenditures, 1915–16.—$10,495.

Handling and Grading Grain at Country Elevators:

Object.—To improve the methods of handling and grading grain at country elevators and to demonstrate to the managers of these elevators the importance of buying grain on the basis of grade, thereby encouraging better farm methods and practices.

Procedure.—Analysis of samples secured from farmers' wagons as delivered at country elevators and from cars representing shipments of grain from country elevators.

Cooperation.—Managers of country elevators, and farmers.

Location.—Washington, D. C.; grain belt of Illinois; and wheat sections of Middle and Northwestern States.

Date begun.—1907.

Results.—The bulk of grain and especially corn has been shown to have an excessive moisture content, and in the case of small grains an excessive quantity of dirt for best returns. Discrepancies have been found in the grading of like classes of grain delivered by different farmers, and in many sections it has been shown that the same price is being paid for grain varying widely in quality and value, thus putting a premium on poor farming. It has been likewise shown that the market to which corn is shipped has an important bearing on the quality and condition of grain on arrival at destination.

Assignment.—J. W. T. Duvel, C. A. Russell.

Proposed expenditures, 1915–16.—$7,875.

Handling and Grading Grain in Terminal Markets:

Object.—To investigate the methods of handling and grading grain in terminal markets, with a view to placing grading on a uniform and definite basis, so that the shipper will have his grain graded under the same rules regardless of the market in which it is sold.

Procedure.—The sampling of grain representing receipts and shipments in the various markets, and the analysis of such samples to ascertain the variation in grading.

Cooperation.—Grain-inspection departments, grain dealers, and elevator companies at the larger markets.

Location.—Washington, D. C., and terminal markets in the United States.

Date begun.—1907.

Results.—This investigation has shown that there is a wide variation as to the quality of grain covered by the same commercial grade in different markets and in the same market at different seasons of the year.

Assignment.—J. W. T. Duvel, W. P. Carroll, John H. Cox, Philip Rothrock, E. L. Morris, L. M. Jeffers.

Proposed expenditures, 1915–16.—$15,330.

Quality and Condition of American Export Grain:

Object.—To build up a more satisfactory trade in grain and to reestablish confidence of the European buyer in American grain certificates.

Procedure.—The sampling of cargoes at the time of shipment for the purpose of determining the quality and condition of the grain as loaded, and the resampling of the cargo at the time of discharge in Europe in so far as funds will permit.

Cooperation.—Atlantic steamship companies and grain exchanges at export markets.

Location.—American and European ports; headquarters at Washington, D. C.

Date begun.—1907.

Results.—It has been shown that much of the grain is loaded in bad condition, being damp, dirty, damaged, and frequently mixed with other

Quality and Condition of American Export Grain—Continued.

grains; also that the complaints from European buyers of the quality and condition of American grain have in the main been justified. Corn is frequently exported under the grade of No. 2 containing 20 per cent or more of moisture. Oats consigned as No. 2 White Clipped frequently carry more than 10 per cent of barley, etc. Data in B. P. I. Circular 55.

Assignment.—J. W. T. Duvel, E. G. Boerner.

Proposed expenditures, 1915–16.—$1,940.

Quality and Condition of Grain Imported into the United States:

Object.—To determine the quality and condition of import grain at time of discharge at American ports.

Procedure.—Samples of various cargoes of grain received at the United States ports are secured and analyzed.

Cooperation.—Grain exchanges and individual grain importers at import markets.

Location.—Grain-receiving ports of the United States; headquarters at Washington, D. C.

Date begun.—1907.

Results.—Most of this work has been limited to Argentine corn and oats examined at Atlantic and Gulf ports. Some of the corn is received in a very badly damaged condition, although some shipments have been first class.

Assignment.—J. W. T. Duvel, E. G. Boerner.

Proposed expenditures, 1915–16.—$500.

Deterioration of Export Grain during Transit in Steamships:

Object.—To determine the changes which take place in export grain during ocean transit.

Procedure.—Cargoes are sampled at the time of loading and equipped with special apparatus for ascertaining the temperature and other factors during the voyage, a representative of the department accompanying the cargo making observations in transit and resampling the cargoes at time of discharge.

Cooperation.—Trans-Atlantic steamship companies from ports of Baltimore and New Orleans; European importers.

Location.—American and European ports and ocean transportation routes; headquarters, Washington, D. C.

Date begun.—1907.

Results.—Comparisons of the analyses of samples taken at the time of loading and discharge show marked changes during transit. A considerable percentage of corn becomes damaged during transit in steamships which damage can be traced directly to the inferior quality and high moisture content of the corn at time of loading and in many cases to the location in the ship where such corn is loaded. The loading of grain in holds adjacent to the boiler and engine room without full protection from artificial heat is a practice detrimental to the grain interests of the United States, and should be prohibited. In some instances steamship companies have taken the necessary steps to remedy such evils.

Assignment.—J. W. T. Duvel, E. G. Boerner.

Proposed expenditures, 1915–16.—Work temporarily suspended; no allotment.

Deterioration of Grain in Storage and during Transit in Cars:

Object.—To determine the degree of deterioration in grain during transit in cars and during storage.

Procedure.—Samples are taken at time of loading and discharging grain in cars to ascertain the deterioration during transit, special shipments being equipped with apparatus for ascertaining the temperature and other factors, in which case a representative of the department accompanies the shipments to make observations in transit.

Cooperation.—Grain producers, and elevator, warehouse, and transportation companies.

Location.—Baltimore, New Orleans, and Chicago; laboratory work, Washington, D. C.

Date begun.—1907.

Deterioration of Grain in Storage and during Transit in Cars—Continued.

Results.—Comparisons of analyses of samples taken at the time of loading and discharge show marked changes during transit. Causes of much loss from deterioration have been determined. Data in B. P. I. Circular 43. Oat-storage experiments show that ventilation has considerable influence on keeping qualities.

Assignment.—J. W. T. Duvel, John H. Cox, W. P. Carroll.

Proposed expenditures, 1915–16.—$1,850.

Shrinkage of Grain while in Storage and Transit:

Object.—To determine the amount of shrinkage, in storage or transit, in grain containing various percentages of moisture.

Procedure.—The shipment of known quantities of corn in specially selected box cars accompanied by a representative of the department; moisture content of corn ascertained at time of loading to learn its relation to shrinkage; cars of grain also held on track to compare shrinkage with that of grain shipped.

Cooperation.—Transportation and elevator companies.

Location.—Baltimore, New Orleans, and Chicago; laboratory work, Washington, D. C.

Date begun.—1911.

Results.—Investigations show that shrinkage during transit or while in storage depends mainly on moisture content, temperature of air, and general atmospheric conditions; greater shrinkage shown in grain held on track than in that shipped. Data in B. P. I. Circulars 32 and 81; also Department Bulletin 48.

Assignment.—J. W. T. Duvel, John H. Cox, W. P. Carroll.

Proposed expenditures, 1915–16.—Work temporarily suspended; no allotment.

Keeping Qualities of Grain as Influenced by Various Kinds of Storage Bins:

Object.—To determine the relative value of various sorts of storage bins and elevators for the storage of bulk grain.

Procedure.—Duplicate lots of specially selected grain are stored in bins and elevators of different constructions, such as concrete, wood, steel, etc.

Cooperation.—Grain elevator and storage companies in Baltimore and Chicago.

Location.—This work is directed from Washington, D. C.

Date begun.—1907.

Results.—Investigations indicate the superiority of wooden bins over concrete bins.

Assignment.—J. W. T. Duvel, E. G. Boerner, W. P. Carroll, John H. Cox, C. A. Russell.

Proposed expenditures, 1915–16.—No allotment; work temporarily suspended.

Artificial Drying of Grain:

Object.—To secure a basis for fixing standard grades for artificially dried grain.

Procedure.—Investigations are made and samples examined to determine the relative value of artificially dried and naturally dried grain containing different percentages of moisture; the influence of different degrees of temperature; the difficulties of handling artificially dried grain; the keeping qualities when stored under commercial conditions; and the relative market value and grade of same as compared with grain dried under natural conditions.

Cooperation.—Railroad and elevator companies that operate commercial grain driers.

Location.—Washington, D. C., and Baltimore, Md.

Date begun.—1907.

Results.—It has been shown that greater loss results in handling artificially dried grain than with naturally dried grain and that there is little change in acidity, germination, and chemical composition after drying.

Assignment.—J. W. T. Duvel, John H. Cox.

Proposed expenditures, 1915–16.—No allotment; work temporarily suspended.

Bleaching of Grain:

Object.—To determine the influence of bleaching on the value of low-grade grain.

Procedure.—Special samples of grain before and after bleaching are secured and determinations necessary for a comparison of their relative value made, including studies of changes in moisture content, of differences in appearance, of the molds present before and after bleaching, and of the grade which such grain would receive on the basis of its improved appearance.

Cooperation.—Bureau of Animal Industry and operators of grain bleachers.

Location.—Washington, D. C., and Chicago, Ill.

Date begun.—1907.

Results.—Preliminary investigations made, but without definite results; further tests to be made. Data in B. P. I. Circulars 40, 74, and 111.

Assignment.—J. W. T. Duvel, W. P. Carroll.

Proposed expenditures, 1915–16.—No allotment; work temporarily suspended.

Mixing of Varieties, Classes, and Commercial Grades of Grain:

Object.—To ascertain the extent to which mixing is done in large markets and at country elevators, either intentionally or through carelessness in handling, and to ascertain the extra profits resulting from such mixing.

Procedure.—In order to secure a basis for comparison a study is being made of the extent to which classes and varieties of grain are grown together on the farm in various sections of the United States. These data are then compared with grain as received and handled at both secondary and primary markets. The work on the farm involves field studies beginning before the grain is harvested.

Cooperation.—Grain producers, dealers, receivers, shippers, and inspection departments of the United States.

Location.—Washington, D. C.; Baltimore, Md.; Kansas City, Mo.; Decatur, Ill.; New Orleans, La.; Portland, Oreg.; and various points in the corn and wheat belts.

Date begun.—1907.

Results.—Investigations have shown that different classes and varieties of grain sometimes grow together on the farm, both as a result of carelessness in seed selection and because of intentional mixtures with the hope of securing larger yields of grain better suited for feeding purposes. For example, wheat is frequently found mixed with rye, mainly as a result of carelessness in the selection of seed. Barley is frequently sown with oats, but only very limited quantities of such mixtures are marketed. Such mixtures as are found on the market are usually made by operators of elevators for increased profits.

Assignment.—J. W. T. Duvel, W. P. Carroll, L. M. Jeffers, L. M. Thomas, E. L. Morris, Philip Rothrock, John H. Cox.

Proposed expenditures, 1915–16.—$3,250.

Milling and Baking Investigations with Various Classes, Varieties, and Grades of Wheat:

Object.—To determine the milling value of various kinds and grades of wheat to serve as a basis for the fixing of standard grades.

Procedure.—Samples of the same variety and class of wheat are secured in different sections of the country for milling and baking tests. Likewise, the milling and baking tests are made on samples representing the same commercial grade in different markets and the different grades in the same market.

Cooperation.—North Dakota Experiment Station.

Location.—Fargo, N. Dak.; Portland, Oreg.; and the wheat belts of the United States.

Date begun.—1907.

Results.—It has been shown that there is a wide variation in the quality of bread made from the same commercial grades of wheat secured in different markets, that the same class and variety of wheat grown in different sections of the country do not have the same milling and baking value, and that the method of handling wheat on the farm has an important bearing on its milling and baking value, stack-thrashed wheat being superior to shock-thrashed grain.

Assignment.—J. W. T. Duvel, L. M. Thomas.

Proposed expenditures, 1915–16.—$6,105.

Harvesting, Handling, Storing, and Grading Rice:

Object.—To improve present methods of handling and storing rice on the farm, in the warehouse, and at the mill, and to establish definite standards for rice.

Procedure—Experiments in different methods of handling rice on the farm after it is harvested; sampling rice as it is delivered at the warehouses by the planters; investigations of the keeping qualities of rice as stored with different percentages of moisture and of the milling yield resulting from different methods of handling rice both on the farm and in the warehouses.

Cooperation.—Southern Rice Growers' Association, Louisiana and Texas Rice Millers' and Distributors' Association, and rice growers, dealers, and millers.

Location.—Rice-growing sections of the United States, principally Louisiana, Texas, and Arkansas.

Date begun.—1911.

Results.—Investigations have been made leading to the fixing of grades for rice. Milling tests show there is a loss in value of 8 to 20 per cent where rice is not well shocked. Rice coated with glucose and talc is damaged equally as bad by weevils as rice stored in an uncoated condition. Under ordinary shipping conditions milled rice as shipped is damaged but very little by breakage in handling.

Assignment.—J. W. T. Duvel, F. B. Wise.

Proposed expenditures, 1915–16.—$3,955.

Dockage as a Factor in Grain Grading:

Object.—To determine the amount and different kinds of impurities mixed with grain at the time of thrashing and marketing and the influence of such mixing on market grade and value.

Procedure.—Representative samples of wheat and other grains as thrashed, as delivered at country elevators and as received at terminal markets in carload lots, are secured and examined to determine the kinds and amounts of impurities in the grain. Special tests are made with wheat containing definite known amounts of practically inseparable impurities, to study the effects on milling and baking qualities. Cooperative work is carried on with mills and elevators to study the amount and character of the material removed when cleaning wheat for milling.

Cooperation.—Grain growers, receivers, shippers, and inspection departments in the United States and Canada.

Location.—Grain-growing sections of the United States and Canada; headquarters, Washington, D. C.

Date begun.—1907.

Results.—Investigations and special milling and cleaning tests show that the present machinery ordinarily found in mills and elevators does not remove impurities such as rye, barley, king-head, cockle, and wild-rose seed in cleaning wheat for grinding; also that these impurities result in lowering the milling and baking qualities of flour; and that a considerable amount of small, broken, and shriveled wheat is removed in the process of preparing wheat for the rolls.

Assignment.—R. C. Miller, J. W. T. Duvel.

Proposed expenditures, 1915–16.—$4,380.

Feeding and Manufacturing Value of Sound and Unsound Grain:

Object.—To secure definite information on which to base values of the different kinds of damaged grain for the purpose of grading.

Procedure.—Feeding tests are made with sound and various kinds of damaged grain to ascertain their effect on animals, both in weight and pathological conditions that might develop. Tests are conducted to ascertain the quality of grain that can be used for various kinds of manufacturing purposes, with reference to yield and quality. So far, this work has been limited mainly to feeding tests with sound and damaged corn and bleached and unbleached oats.

Cooperation.—Bureau of Animal Industry.

Location.—Washington, D. C., and Bethesda, Md.

Date begun.—1907.

Feeding and Manufacturing Value of Sound and Unsound Grain—Continued.

Results.—In preliminary tests no important results were shown in the case of oats, but the gain in weight of the animals that were fed damaged corn was much less than those fed sound corn.

Assignment.—J. W. T. Duvel.

Proposed expenditures, 1915–16.—$500.

Grain Values as Influenced by Biochemical Changes Which Take Place after Harvesting and during Storage:

Object.—To ascertain whether the value of grain increases as a result of biochemical changes which take place after harvesting and during storage.

Procedure.—This project is largely one of scientific interest, embodying biochemical studies of such important changes as take place in the sweating and curing of grain.

Location.—Washington, D. C.

Date begun.—1911.

Results.—Only very limited work has been done on this project. It is known that grain after harvesting goes through a sweating process, and that under proper conditions this process results in the improvement of the quality of grain, but sufficient work has not been done to justify any conclusions as to what these changes are.

Assignment.—J. W. T. Duvel, G. H. Baston.

Proposed expenditures, 1915–16.—$250.

Changes in Chemical Composition of Grain during Deterioration:

Object.—To determine changes in the chemical composition of grain.

Procedure.—Samples of grain are secured from special experimental lots representing different stages and degrees of deterioration such as take place in grain during storage in elevators and in transit in cars and steamships.

Cooperation.—Bureau of Chemistry.

Location.—Washington, D. C.

Date begun.—1911.

Results.—Investigations have shown that in corn that deteriorated during storage there is marked decrease in the percentage of acid, a reduction in the sugars, and, where deterioration is pronounced, a decrease in the percentage of fat. The increase in the acidity of corn is the most important factor in determining the degree of soundness of corn. Data in Department Bulletin 102.

Assignment.—J. W. T. Duvel, H. J. Besley, G. H. Baston.

Proposed expenditures, 1915–16.—$1,150.

Development of Laboratory Methods for the Determination of Soundness of Grain:

Object.—To develop simple laboratory methods for measuring various factors taken into consideration in the commercial grading of grain.

Procedure.—Experimental work with different methods is undertaken with a view to developing new ones or revising old ones, so that they will be applicable to commercial conditions which require that samples be handled rapidly.

Cooperation.—Bureau of Chemistry.

Location.—Washington, D. C.; Baltimore, Md.; Chicago, Ill.; Decatur, Ill.; Fargo, N. Dak.; Kansas City, Mo.; New Orleans, La.; and Portland, Oreg.

Date begun.—1907.

Results.—A method has been developed for testing sulphur-bleached oats and barley and for determining the acidity of corn, which is the most important means known for measuring the degree of soundness. By modifications of methods previously known and used the time has been reduced from 16 or 18 hours to approximately 30 minutes.

Assignment.—J. W. T. Duvel, H. J. Besley, G. H. Baston.

Proposed expenditures, 1915–16.—$2,440.

Development of Special Apparatus for Use in Grain Grading:

Object.—To design and develop new apparatus for use in connection with the commercial grading of grain.

Procedure.—Tests are made with various kinds of apparatus for measuring different factors in the grading of grain, such as weight per bushel, moisture content, etc.

Development of Special Apparatus for Use in Grain Grading—Continued.

Location.—Washington, D. C.; Baltimore, Md.; Chicago, Ill.; Decatur, Ill.; Fargo, N. Dak.; Kansas City, Mo.; New Orleans, La.; and Portland, Oreg.

Date begun.—1907.

Results.—Apparatus has been developed for rapidly determining the moisture content in grain and a special flask devised for determining the moisture content in meal and flour and grain products; a special device for securing representative samples of bulk lots of grain; modification of tester to determine weight per bushel of grain, so as to give more reliable results; development of special balance for rapidly weighing various determinations, and other apparatus of minor character necessary for successful prosecution of the work.

Assignment.—J. W. T. Duvel, E. G. Boerner, John H. Cox, H. J. Besley, G. H. Baston.

Proposed expenditures, 1915–16.—$2,320.

Total, Grain-Standardization Investigations, $88,820.

[Research.]

BIOPHYSICAL INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—General supervision of biophysical investigations, preparation of data for publication, and the conduct of clerical routine.

Location.—Washington, D. C.

Date begun.—1906.

Assignment.—L. J. Briggs, J. O. Belz.

Proposed expenditures, 1915–16.—$7,380.

COOPERATIVE BIOPHYSICAL INVESTIGATIONS.

Cooperative Biophysical Investigations:

Object.—To determine the effect of various methods of soil preparation and crop rotation upon the moisture content, temperature, humus content, soluble-salt content, aeration, and other physical properties of the soil; and to provide data for a comparison of the soil and climatic conditions at the various stations in relation to crop production.

Procedure.—This work has involved the systematic measurement of the soil moisture and climatic conditions at the various stations where field work is being conducted by the offices listed below. The Office of Biophysical Investigations has outlined the method of procedure, provided the apparatus and equipment, supervised the observations, and assisted in reducing the results. The field observations have for the most part been made by the field staff of the cooperating offices. Special investigations have also been conducted in cooperation with the Office of Alkali and Drought Resistant Plant Investigations to determine the amount of water required by different crops for the production of a pound of dry matter and the effect of climatic conditions upon such water requirement.

Cooperation.—Offices of Dry-Land Agriculture Investigations, Western Irrigation Agriculture Investigations, Cereal Investigations, Forage-Crop Investigations, and Alkali and Drought Resistant Plant Investigations.

Location.—Yuma, Ariz.; Biggs, Cal.; Akron, Colo.; Aberdeen, Idaho; Colby, Garden City, and Hays, Kans.; Huntley and Judith Basin, Mont.; Mitchell and North Platte, Nebr.; Fallon, Nev.; Tucumcari, N. Mex.; Mandan, Dickinson, Williston, and Edgeley, N. Dak.; Newell, S. Dak.; Burns, Moro, and Umatilla, Oreg.; Amarillo, Big Spring, Chillicothe, and Dalhart, Tex.; Nephi, Utah; Arlington, Va.; Archer, Wyo.; Lawton, Okla.; and Washington, D. C.

Date begun.—1906.

Results.—The results of the work have been embodied in various publications of the offices mentioned and are continually being used in the prosecution and investigation of the work. The soil-moisture determinations in particular are valuable in determining the methods of tillage most suitable to the Great Plains and elsewhere, while the evaporation

Cooperative Biophysical Investigations—Continued.

and other climatic measurements have been very useful in comparing and interpreting results obtained at different stations and at the same stations during different years. The water-requirement measurements have shown that plants differ greatly in the amount of water required for the production of a pound of dry matter, and varieties of the same crop often exhibit marked differences in this respect. Other things being equal, the crop with the lowest water requirement is the one best adapted to dry-land regions, and results so far obtained give promise that strains much more efficient than those now in use may be developed for dry-land sections.

Assignment.—L. J. Briggs, J. O. Belz, A. B. Campbell.

Proposed expenditures, 1915–16.—$10,900.

SPECIAL BIOPHYSICAL INVESTIGATIONS.

Electrical Method of Determining Moisture Content of Grain:

Object.—To develop an electrical method which can be used for the rapid determination of the moisture content of grain in transit with accuracy sufficient for commercial purposes.

Procedure.—Laboratory and elevator tests are conducted at Washington and Baltimore. It was at first believed that the method could be developed so as to measure the moisture content of the grain in the car without the necessity of drawing samples. A careful investigation showed, however, that the required accuracy could not be obtained in this way. The method was then developed for use in the laboratory, and a thorough test of the method has been made, both in Washington and Baltimore, the results being checked by the Office of Grain Standardization.

Location.—Washington and Baltimore.

Date begun.—1906.

Results.—The results obtained during the past two years indicate that this method can be used for determining the moisture content of wheat and corn with an accuracy comparable to that of the Brown and Duvel boiling-oil method. It is believed that the apparatus will be found practical and useful in the commercial grading of grain on account of its simplicity and rapidity.

Probable date of completion.—1916.

Assignment.—L. J. Briggs, A. B. Campbell.

Proposed expenditures, 1915–16.—$400.

Relation of Soil Moisture and Soil Solutions to the Growth of Plants:

Object.—To determine the cause of mottle-leaf, a malnutrition trouble of citrus in California and elsewhere, and to develop cultural and other methods of treatment for bringing about a normal growth. This is a serious problem in certain citrus sections of California and leads to a marked reduction in yield and ultimately to the destruction of the groves.

Procedure.—A field laboratory has been established at Riverside, Cal., which is in the center of one of the worst mottle-leaf sections. Field and laboratory experiments have been actively carried on during the past two years with a view to determining the difference in the soils in the good and the poor groves and to test the efficiency of certain remedial measures based upon the laboratory experiments.

Cooperation.—Southern California Citrus Experiment Station and citrus growers.

Location.—Headquarters at Riverside, Cal.; investigations include the whole tributary citrus district.

Date begun.—1912.

Results.—Results indicate that mottle-leaf may be due to a variety of causes, but that an important contributing cause is the low humus content of the citrus soils, especially when accompanied by low humus-lime ratio. Experimental groves under treatment are already showing a most gratifying improvement from the use of manure, bean straw, or other humifying material, especially when applied as a permanent mulch on the surface, so that all cultivation is eliminated.

Assignment.—L. J. Briggs, C. A. Jensen, J. W. McLane.

Proposed expenditure, 1915–16.—$10,000.

Electroculture:

Object.—To determine whether the electrical treatment of plants results in a stimulation of growth or an increased yield of grain.

Procedure.—Experiments have been conducted with wheat grown in field plats at Arlington Farm and in the greenhouse at Washington. In most of the experiments an insulated network suspended above the plats has been charged for several hours each day to a high positive potential. This procedure is said by some European investigators to have given increased yield of the crop. In addition to the direct-current experiments, rapidly alternating currents have been applied to the network. The effect of the ordinary alternating-current power line attached to the network has also been tried.

Location.—Arlington, Va., and Washington, D. C.

Date begun.—1906.

Results.—The relative productivity of the check plats and the electrified plats was determined by direct experiment before the electrical experiments were undertaken. In no case has an appreciable stimulation in growth resulted from any electrical treatment so far employed. Neither was the appearance changed nor the yield of dry matter or grain increased by the electrical treatment. The experiments have consistently shown that none of the electrical treatments so far tried result in any appreciable stimulation in growth.

Probable date of completion.—1916.

Assignment.—L. J. Briggs, A. B. Campbell.

Proposed expenditures, 1915–16.—$900.

Total, Special Biophysical Investigations, $11,300.

Total, Biophysical Investigations, $29,580.

SEED-TESTING LABORATORIES.

Supervision:

Object.—To carry on the supervisory and clerical work of the seed-testing laboratories.

Location.—Washington, D. C.

Date begun.—1893.

Assignment.—E. Brown.

Proposed expenditures, 1915–16.—$9,870 (research, $9,315; regulation, $555).

[Research.]

Seed Testing:

Object.—To test for mechanical purity or vitality samples of seed submitted by firms or individuals, and to report to them the results of such tests; to make examination of samples of seeds for the presence of adulterants or dodder; and to make identifications of weed seeds.

Procedure.—At the request of the sender samples of seed submitted to the Washington seed laboratory are identified, examined for the presence of adulterants or dodder, or tested for mechanical purity or vitality. Reports are sent giving the results of the examination and other information of value to the man who sows the seed.

Location.—Washington, D. C.; Columbia, Mo.; Corvallis, Oreg.; Lafayette, Ind.; Berkeley, Cal.; and Baton Rouge, La.

Date begun.—1893.

Results.—During the calendar year 1914, 12,633 samples, exclusive of those connected with projects "Adulterated-seed investigations" and "Enforcement of the seed importation act," were received. As in previous years, these samples have been examined and most of them tested for purity or germination, or both. These samples came from the following sources: Commercial samples from farmers and seedsmen, 4,084; noncommercial samples, including those used in special investigations of this laboratory and in investigational work of other offices of the bureau, 4,940; samples from the Office of Foreign Seed and Plant Introduction and the Office of Seed Distribution, 1,222; samples of forage-plant seeds from customhouses, 2,387; total, 12,633. As in previous years, an effort has been made to divert to the branch laboratories samples of seeds sub-

Seed Testing—Continued.

mitted for purity and germination tests and to devote more of the work of this laboratory to investigational and general work.

Assignment.—E. Brown, W. L. Goss, Emma F. Sirrine.

Proposed expenditures, 1915–16.—$16,290.

Seed Purity and Vitality Investigations:

Object.—To study the quality of commercial seeds; to study crop seeds and the weed seeds found in them with a view to their definite identification; to determine the origin of commercial seeds by means of the weed-seed content; to collect and distribute authentic seeds for use in identification by comparison; to develop improved laboratory methods of testing seeds for vitality; to determine the agricultural value of hard seeds; and to study methods of harvesting, curing, and storing best adapted to preserve vitality; to investigate the morphological, physiological, and chemical conditions affecting the germination of seeds.

Procedure.—Closely related groups of seeds are studied, and the characters by which they can be distinguished are described and illustrated. Weed seeds found in seeds of foreign origin are studied, described, and illustrated as a means of determining the place of origin of imported seeds. Various kinds of commercial seeds are examined from time to time, and publications are issued calling attention to any unusual conditions of quality or origin. Weed seeds and economic seeds are put up in sets and sent to schools and individuals on payment for the containers. Comparative germination tests of seed are made under varying conditions of temperature, light, moisture, etc., to determine the optimum conditions for each kind. This work is supplemented by histological, physiological, and field studies.

Location.—Washington, D. C.

Date begun.—1905.

Results.—An examination was made of the commercial methods of grinding screenings used in compounding mixed feeds, including molasses feeds. It was found that the methods employed in the best mills are such as to insure grinding and thereby killing all weed seeds contained in the screenings. This effectually offsets the contention frequently made that the weed seeds in screenings can not be economically and effectually ground. Studies on closely related groups of seeds have been continued with a view to their better identification. An examination of the alfalfa seed-producing regions of Europe showed that practically all of the alfalfa seed imported into the United States originated in Russian Turkestan, thus bringing to this country a type of seed not well adapted to general conditions here. A simple and positive means of identification of Turkestan alfalfa seed was found. Publication issued: B. P. I. Bulletin 138, "Commercial Turkestan Alfalfa Seed." The collection of authentic material for distribution in seed sets has been continued. The investigation of the seeding value of hard seeds has been continued. It has been definitely proved that practically all of the seeds of the smaller legumes, such as red, white, and alsike clover, alfalfa, and sweet clover, can be rendered capable of immediate germination by the proper adjustment of the hulling machine.

Assignment.—F. H. Hillman, G. T. Harrington.

Proposed expenditures, 1915–16.—$5,350.

Adulterated-Seed Investigation:

Object.—To publish information as to the extent of the sale of adulterated or misbranded forage-plant seeds, including the analyses of such seeds, with the names and addresses of the dealers selling them.

Procedure.—Each year about 50 agents of the department are appointed who as individuals purchase seeds in the usual course of the trade. These samples are analyzed and, when found to be adulterated or misbranded, the analyses, together with the names and addresses of the persons or firms selling the seeds, are published.

Location.—Washington, D. C.

Date begun.—1904.

Results.—During the calendar year 1914, seeds of orchard grass, Kentucky bluegrass, hairy vetch, and sweet clover were collected. Only 19 samples of adulterated or misbranded Kentucky bluegrass were found. Of the orchard-grass samples, 10 per cent, as compared with 2 per cent in 1912,

Adulterated-Seed Investigation—Continued.

were found to be adulterated or misbranded. This increase was no doubt due to the relatively higher price of orchard-grass seed in 1914. Twenty-five per cent of the hairy-vetch seed samples are being published as adulterated or misbranded, as compared with 53 per cent in 1912. Sweet-clover seed was collected for the first time in 1914, and less than 65 per cent of the lots secured were true to name. Nearly half of those lots sold as yellow sweet clover were the small annual species instead of the tall-growing biennial species. Results published in an unnumbered circular of the Office of the Secretary, "The Adulteration and Misbranding of the Seeds of Kentucky Bluegrass and Redtop."

Assignment.—E. Brown, Emma F. Sirrine.

Proposed expenditures, 1915–16.—$5,200.

[Regulation.]

Enforcement of the Seed-Importation Act:

Object.—The enforcement of the seed-importation act of August 24, 1912, the object of this act being to prohibit the importation into the United States of certain specified seeds when adulterated or unfit for seeding purposes.

Procedure.—All lots of imported forage-plant seeds specified in the act are sampled by customs officers and the samples forwarded to the nearest district seed-testing laboratory. The samples are examined and the customs officers directed to release or refuse delivery of the shipment according to whether it does or does not conform to the requirements of the act.

Location.—Washington, D. C.

Date begun.—1913.

Results.—During the calendar year 1914, 796 lots of imported seed were examined under the seed-importation act, of which 42 were found to be unfit for entry under the act. Of the 42 lots rejected, 21 were exported, 15 were recleaned in bond and subsequently admitted, 1 was admitted through error, the customs service failing to carry out instructions of this department, and 5 are awaiting final disposition.

Assignment.—E. Brown.

Proposed expenditures, 1915–16.—$2,150.

Total, Seed-Testing Laboratories, $38,860 (research, $35,483; regulation, $3,377).

[Research.]

CEREAL INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—To direct field investigations and laboratory studies, and to supervise clerical work, including correspondence, preparation of manuscripts and reports, financial records, maintenance of property and supplies, preparation of photographic material, maintenance of miscellaneous files and herbaria, seed distribution, and the general details connected with the field and laboratory investigations.

Location.—Washington, D. C.

Date begun.—1901.

Assignment.—M. A. Carleton.

Proposed expenditures, 1915–16.—$21,889.

PRODUCTION AND IMPROVEMENT OF CEREALS AND CEREAL PRODUCTS.

Wheat Investigations:

Object.—To determine varietal adaptations and the factors influencing them; to improve the crop through selection and hybridization of varieties and races; to study and improve production methods; to study inheritance in hybrids; and to identify, describe, and classify varieties.

Procedure.—The comparative values of varieties and races are tested on replicated field plats to determine yielding power, adaptation and proper dates, rates, depths, and methods of seeding. Selections of promising

Wheat Investigations—Continued.

individuals are made and compared and the best increased. Crosses are made to combine desirable characters and to study the phenomena of inheritance. All available domestic and foreign varieties and strains are obtained, grown in nurseries, studied, preserved in herbaria, described, and classified.

Cooperation.—State experiment stations in Georgia, Idaho, Iowa, Kansas, Maryland, Minnesota, Missouri, Montana, New York (Cornell), North Dakota, Oregon, South Dakota, and Utah; Amarillo Chamber of Commerce; Wyoming Board of Farm Commissioners.

Location.—Athens, Ga.; Aberdeen, Idaho; Ames, Iowa; Hays and Manhattan, Kans.; College Park, Md.; St. Paul, Minn.; Columbia, Mo.; Moccasin, Mont.; Ithaca, N. Y.; Dickinson and Williston, N. Dak.; Burns and Moro, Oreg.; Brookings, Cottonwood, Highmore, and Newell, S. Dak.; Nephi, Utah; Chico, Cal.; Akron, Colo.; Amarillo, Tex.; Arlington, Va.; and Archer, Wyo.

Date begun.—1890.

Results.—Results published in B. P. I. Circulars 12, 59, 61, and 79; B. P. I. Bulletins 3, 70, 178, 240, 269, and 283; Department Yearbook Separates 195, 511, and 649; Department Bulletins 30, 33, 39, 157, and 270; and Farmers' Bulletins 139, 466, 534, 596, 616, 678, and 680. The varieties of high quality which are the best average yielders under varying seasonal conditions have been determined for several districts. These results either have been published or are being prepared for publication. Directions for growing eastern winter wheats and hard spring common and durum wheats have been published. Valuable strains of Arnautka, Chul, Ghirka, Kubanka, and other varieties have been bred at field stations. Hundreds of varieties and strains have been assembled for identification and classification. About 3,500 separate sowings of these were made in the spring of 1915.

Assignment.—C. R. Ball, J. A. Clark, C. E. Leighty.

Proposed expenditures, 1915–16.—$9,040.

Oat Investigations:

Object.—The improvement of oats by (1) a study of production methods, (2) the breeding of new varieties, and (3) the extension of the winter-oat area.

Procedure.—Extensive varietal tests are conducted. New varieties and selections are being produced by the pure-line method from the better commercial varieties and from hybrids of spring and winter oats. A study of cultivated varieties and of closely allied species preliminary to the classification and description of all American varieties of oats is in progress. Experiments in production methods are conducted, and a study is also made of the methods employed by the best farmers.

Cooperation.—State experiment stations in Georgia, Idaho, Iowa, Kansas, Maryland, Montana, Nebraska, New York (Cornell), North Dakota, Oregon, South Dakota, and Utah; Amarillo Chamber of Commerce; Wyoming Board of Farm Commissioners.

Location.—Athens, Ga.; Aberdeen, Idaho; Ames, Iowa; Hays and Manhattan, Kans.; College Park, Md.; Moccasin, Mont.; Lincoln, Nebr.; Ithaca, N. Y.; Dickinson and Williston, N. Dak.; Burns and Moro, Oreg.; Brookings, Cottonwood, Highmore, and Newell, S. Dak.; Nephi, Utah; Chico, Cal.; Akron, Colo.; Amarillo, Tex.; Arlington, Va.; and Archer, Wyo.

Date begun.—1902.

Results.—Data given in Farmers' Bulletins 395, 420, 424, and 436; B. P. I. Bulletins 182, 240, and 283; B. P. I. Circulars 12, 30, 59, and 61; and Department Bulletins 30, 33, 39, 99, and 270. New varieties of spring oats have been distributed through the Cornell University and the Iowa experiment stations and selected stocks of winter oats from the Arlington Farm. The best varieties for numerous sections have been determined by varietal tests and the results have been published or are in preparation for publication. Several hundred varieties have been collected and grown in the classification nursery.

Assignment.—C. W. Warburton, T. R. Stanton.

Proposed expenditures, 1915–16.—$4,530.

Barley Investigations:

Object.—Production of new varieties by breeding and incidental inheritance studies upon the crosses made; study of the physiology and morphology of the barley grain; study of production methods; extension of the barley-growing areas by use of new importations and the better utilization of those already at hand; and the agronomic and botanical classification of barley varieties.

Procedure.—Barley hybrids are being produced annually at Arlington, Va., and St. Paul, Minn. These are distributed to field stations where best suited as crosses for earliness—to the Great Plains, for instance. At the present time a new phase of the morphological study of the grain is being undertaken. On the dry-land areas of the West barley often develops a very high nitrogen content. This is undoubtedly a physiological effect, and this result and its significance with reference to the use of barley as a feed are being investigated. The study of production methods is being carried on in certain areas in continuous experiments. Efforts are being made to discover more hardy winter barleys, more drought-resistant summer forms, and more productive types of all kinds. Data are being accumulated upon which to base a classification of the botanical and agricultural varieties of barley. The first is to meet a very persistent demand from agronomists in general, and has been studied incidentally for some time. The second is being started this season with the object of correlating the many observations already recorded by different experimenters, and of interpreting future as well as past data.

Cooperation.—Minnesota and Cornell University experiment stations.

Location.—Arlington, Va.; Ithaca, N. Y.; St. Paul, Minn.; Highmore and Newell, S. Dak.; Dickinson and Williston, N. Dak.; Hays, Kans.; Amarillo, Tex.; Akron, Colo.; Archer, Wyo.; Moccasin, Mont.; Aberdeen, Idaho; Nephi, Utah; Moro and Burns, Oreg.; and Chico, Cal.

Date begun.—1902.

Results.—The results of the past year are best summarized in Department Bulletins 137 and 183. The first gives a résumé of the heritable variations in barley as a basis of breeding. The second reports fully the mechanism of enzym secretions in the grain, upon which the value of malting barley depends.

Assignment.—H. V. Harlan, Stephen Anthony.

Proposed expenditures, 1915-16.—$5,040.

Rice Investigations:

Object.—The improvement of rice by a study of the cultural requirements and varietal adaptations and by selection and breeding.

Procedure.—Rices from foreign countries are introduced and tested for earliness of maturity, quality, and yielding power. From the promising varieties individual plants of the most desirable types are selected. In this way superior types are developed and increased for distribution. Cultural tests are made to determine how yield may be affected by different depths of plowing, different methods of preparing the seed bed, and different rates, depths, and dates of seeding. Various commercial fertilizers are used at different rates to determine their effect on yield. The water requirements of the crop are determined by the application of irrigation water at different depths and dates of submergence, noting the effects of stagnant water as compared with slowly changing water, and no irrigation. The control of weeds is determined largely through rotations containing cultivated crops. The nursery is used for botanical and hybridization studies.

Cooperation.—Louisiana Experiment Station and Sacramento Valley Grain Association of California.

Location.—Crowley, La., and Biggs, Cal.

Date begun.—1905.

Results.—New varieties have been distributed for commercial plantings; hybrids have been produced that are resistant to the fungous disease *Piricularia oryzae*, commonly known as "rotten neck," and control of red rice by rotations containing cultivated crops has been demonstrated. The investigations of rice in the Sacramento Valley of California are reported in B. P. I. Circular 97. A Farmers' Bulletin on the culture of rice in California is in preparation.

Rice Investigations—Continued.

Assignment.—Charles E. Chambliss, J. Mitchell Jenkins, E. L. Adams.

Proposed expenditures, 1915–16,—$3,525. (In addition to this amount, expenditures at the Crowley, La., and Biggs, Cal., rice stations are estimated at $8,000, making a total of $11,525 for rice work. See project group, "Maintenance of General Cereal Field Stations.")

Grain-Sorghum and Broom-Corn Investigations:

Object.—To improve varieties by breeding, determine varietal adaptations, extend the producing area, study cultural requirements, determine human-food value of sorghum meal, and promote commercial uses of these crops.

Procedure.—Domestic and foreign varieties and strains are tested on field plats to determine adaptation and yielding power of grain and brush. Selections of promising varieties are made. Proper dates, rates, methods of seeding, time of harvesting, and methods of curing the brush are studied.

Cooperation.—Experiment stations of Kansas and South Dakota and to a minor extent of other Western States.

Location.—Amarillo and San Antonio, Tex.; Woodward, Okla.; Hays and Garden City, Kans.; Akron, Colo.; Highmore and Newell, S. Dak.; Moro, Oreg.; and Biggs, Cal.

Date begun.—Grain sorghums, 1905; broom corn, 1911.

Results.—Results published in B. P. I. Circulars 50 and 122; B. P. I. Bulletins 175, 203, 237, 253, and 283; Farmers' Bulletins 322, 448, and 552; and Department Yearbook Separate 625. Manchu kaoliang, an early variety, has been proved adapted to conditions in South Dakota, and the area devoted to this crop is being very materially increased by the farmers. Extensive experiments with broom corn are now being conducted for the second season at Woodward, Okla.

Assignment.—C. R. Ball, B. E. Rothgeb.

Proposed expenditures, 1915–16.—$1,920. (In addition to this amount, it is estimated that $1,850 will be spent at the grain-sorghum and broom-corn field station; making a total of $3,770 for grain sorghums and broom corn. See project group, "Maintenance of General Cereal Field Stations.")

Flax Investigations:

Object.—To extend the possible flax area and to increase the yield, the oil-yielding capacity, and disease resistance of flax.

Procedure.—This project involves the introduction of varieties and the production of new varieties by selection and hybridization. This includes the testing of varieties introduced from India, Turkey, Chinese Turkestan, and Abyssinia in the Western and Southwestern States as both a dry-land and an irrigated crop, and also as a winter crop from Texas to California. Studies of inheritance and adaptations with regard to yield of grain, yield of oil, size of seed, height and branching of plants, disease resistance, and the correlations of these and other characters are under way.

Cooperation.—The experiment stations of Minnesota, Iowa, North Dakota, South Dakota, Montana, Colorado, Utah, Idaho, and Oregon, and the Wyoming Board of Farm Commissioners.

Location.—Dickinson, Mandan, and Williston, N. Dak.; St. Paul, Minn.; Ames, Iowa; Highmore and Newell, S. Dak.; Moccasin and Huntley, Mont.; Mitchell, Nebr.; Akron, Colo.; Aberdeen, Idaho; Burns and Corvallis, Oreg. Minor tests and nursery series at Amarillo and San Antonio, Tex.: Crowley, La.; Moro, Oreg.; Bard and Chico, Cal.; Nephi, Utah; Ithaca, N. Y.; and Phoenix, Ariz.

Date begun.—1913.

Results.—Seventy varieties of flax have been tested in varietal plats and nursery rows at 32 stations in 17 States, and 50 additional introductions secured. Hybrids between the northern flaxes and large-seeded Crete and Indian forms have been secured and the first generations grown in the greenhouse at Arlington, Va. Flax herbarium samples for classification study are being collected. Tests of fall-sown flax made at points in Texas, Arizona, and California have given promising results. Introductions from Turkey, India, and Abyssinia seem better adapted to the drier western and southwestern areas than any of our established varieties. "Cereal Investigations No. 30," a new importation from Smyrna,

Flax Investigations—Continued.

Turkey, has outyielded all of the established strains at all of the principal flax-growing stations and is one of the most promising varieties in the fall-seeding tests in the Southwest. Seventy-five pure lines selected in 1913 were grown at Mandan in 1914 and are being increased this year.

Assignment.—Charles H. Clark.

Proposed expenditures, 1915–16.—$4,000.

Investigations of Minor Cereals:

Object.—The improvement of rye, proso, and buckwheat in yield and quality by means of breeding and study of cultural methods. Studies of rye pollination and the hybridization of rye and wheat are being made.

Procedure.—Varietal tests are being made, and it is planned to conduct breeding operations and to study the field requirements of the crops.

Cooperation.—New York (Cornell), Maryland, Minnesota, Iowa, Kansas, South Dakota, Montana, Idaho, Utah, Oregon, Missouri, and Georgia experiment stations, and the Wyoming Board of Farm Commissioners.

Location.—Arlington, Va.; College Park, Md.; Ithaca, N. Y.; St. Paul, Minn.; Ames, Iowa; Amarillo, Tex.; Manhattan and Hays, Kans.; Akron, Colo.; Archer, Wyo.; Highmore and Newell, S. Dak.; Dickinson and Williston, N. Dak.; Moccasin, Mont.; Aberdeen, Idaho; Nephi, Utah; Moro and Burns, Oreg.; Biggs and Chico, Cal.; Athens, Ga.; Columbia, Mo.; Quitman and Ashburn, Ga.; and Statesville, N. C.

Date begun.—1898.

Results.—Results proving the cross-fertilization of rye have been obtained, and natural rye-wheat hybrids have been discovered. Careful and numerous variety tests have shown that the Voronezh Black proso is much the best variety of that cereal in practically all localities where proso is adapted, other good varieties being, in order, Tambof, Red Lump, Orenburg Red, and Turgai.

Assignment.—M. A. Carleton, C. E. Leighty, C. R. Ball.

Proposed expenditures, 1915–16.—This work is conducted on field stations by leaders of other projects, the cost being included in the field-station projects.

Total, Production and Improvement of Cereals and Cereal Products, $28,055.

MAINTENANCE OF GENERAL CEREAL FIELD STATIONS.

Cereal Field Stations in Semiarid Areas:

Object.—To maintain experimental field stations in various sections of the semiarid West for the purpose of establishing for each section the best cereal varieties; and to determine the proper cropping methods.

Procedure.—The different cereals are investigated at these field stations from about four standpoints: (1) Numerous varieties on first introduction are studied on a very small scale in the nursery to get a rough preliminary idea of their comparative value and to thoroughly understand all the important characteristics of each variety, both for purposes of classification and for possible assignment to larger tests from an economic standpoint. (2) Selections are made from the nursery of varieties best adapted. These are grown in plant-to-row tests; that is, seed of a single individual planted in a row. (3) After comparison in the plant-to-row experiments the seed of the best selections from these series is grown on a still larger scale in plats averaging a tenth acre in size, after which a few of the very best varieties may be grown in field tests and the seed then distributed to farmers. (4) At the same time the well-known standard varieties and the best of those obtained in the varietal tests are grown by different methods of seeding and soil cultivation and in rotation with other crops to determine the best method of handling these cereals as crops. It is planned to operate an additional cereal field station in Washington State in cooperation with the State station.

Cooperation.—State experiment stations in Kansas, South Dakota, North Dakota, Montana, Utah, Idaho, Oregon; Wyoming Board of Farm Commissioners; Amarillo Chamber of Commerce; and Sacramento Valley Grain Association.

Cereal Field Stations in Semiarid Areas—Continued.

Location.—Hays and Manhattan, Kans.; Brookings, Cottonwood, Highmore, and Newell, S. Dak.; Dickinson and Williston, N. Dak.; Moccasin, Mont.; Nephi, Utah.; Aberdeen, Idaho; Burns and Moro, Oreg.; Archer, Wyo.; Amarillo and San Antonio, Tex.; Biggs and Chico, Cal.; Akron, Colo.; and Woodward, Okla.

Date begun.—1902.

Results.—Because of the nature of the work at the field stations, including many experiments coming under other projects, it is almost impossible to segregate results belonging to this project. In a way, the sum of results of different varietal tests and methods of cultivation, brought together in bulletins published by separate stations, may be given as results of this project. For example, the results obtained at the Amarillo Cereal Field Station, showing the importance of intertilled crops in rotation with the cereals, the value of grain sorghums compared with other crops, the unsatisfactory behavior of the small grains, etc., published in B. P. I. Bulletin 283, "Cereal Experiments in the Texas Panhandle," may be given as results of field-station work at this point, although many of these would properly be results coming under other projects. The Smyrna white barley has become well established as a result of field-station work at Moccasin, Mont.; likewise important results showing the value of rotation of legumes with cereals have been obtained at the Moro (Oreg.) station.

Assignment.—M. A. Carleton, E. L. Adams, L. C. Aicher, F. R. Babcock, L. R. Breithaupt, N. C. Donaldson, V. H. Florell, J. W. Jones, F. A. Kiene, jr., G. A. McMurdo, J. H. Martin, J. D. Morrison, J. F. Ross, R. W. Smith, D. E. Stephens.

Proposed expenditures, 1915–16.—$36,765.

Cereal Field Stations in Humid Areas:

Object.—To maintain cereal field stations in different sections of the humid areas for the purpose of establishing the best cereal varieties, and to determine the best methods of cereal production for each section.

Procedure.—Same as preceding project.

Cooperation.—State experiment stations of Maryland, New York (Cornell), Iowa, Minnesota, Louisiana, and Georgia.

Location.—Arlington, Va.; College Park, Md.; Ithaca, N. Y.; Ames, Iowa; St. Paul, Minn.; Crowley, La.; and Athens, Quitman, and Ashburn, Ga.

Date begun.—1902.

Results.—A few of the general and important results are the development of hardier winter barleys at the Arlington Farm; the determination of methods for eliminating red rice at the Crowley Rice Farm; the demonstration of the usual occurrence of cross-fertilization in rye through pollination studies of that cereal at Arlington Farm; the production of better yielding and hardier strains of oats at Arlington Farm, Ithaca, N. Y., and Ames, Iowa. The adaptation of wheat varieties has been determined and the seed of the best employed and distributed to farmers in the States in the humid areas. These varieties include the selections that have been made and tested in comparison with standard varieties and which have been retained because of their excellent yielding qualities. Published data may be found in Farmers' Bulletins 427, 436, 518, 596, and 616, and Department Bulletin 99. Data are also in preparation for publication.

Assignment.—M. A. Carleton, A. D. Ellison, N. Schmitz, W. T. Craig, L. C. Burnett, Lee Alexander, J. Mitchell Jenkins, R. R. Childs.

Proposed expenditures, 1915–16.—$16,616.

Total, Maintenance of General Cereal Field Stations, $53,381.

CEREAL TILLAGE AND ROTATION INVESTIGATIONS.

Cereal Tillage and Rotation Investigations:

Object.—To improve the yield and quality of cereals through better culture methods and rotations, and to eliminate the necessity of frequent summer fallowing on certain dry lands of the West; to increase the humus content of the soil through rotations with intertilled crops and by green manuring.

Cereal Tillage and Rotation Investigations—Continued.

Procedure.—Different methods of preparation of the soil preceding seeding of grain are tested. Rotations of different leguminous crops, particularly Canada peas and alfalfa, in alternation with the cereals are conducted at each of the points where work is done. Wherever Indian corn is at all adapted this crop is being used in alternation with grains, in place of summer fallow, for the conservation of moisture; where Indian corn is not adapted grain sorghums, potatoes, and other crops are used instead. In the main, the same lines of work will be continued during the next year.

Cooperation.—State experiment stations of Utah, Idaho, and Oregon; cooperation with the Washington Experiment Station in contemplation.

Location.—Nephi, Utah; Aberdeen, Idaho; Moro and Burns, Oreg.; and Biggs, Cal.

Date begun.—1904.

Results.—It has been determined that in some places potatoes do well as an intertilled crop alternating with cereals, but often the extent of potato cultivation is not sufficient to make it important in this respect. Indian corn and sorghum in rotation have also been effective in conserving moisture for cereal crops, and have besides sometimes yielded some returns themselves. Excellent results from the use of Canada peas in alternation with cereals have been obtained, particularly in Oregon, causing much better yields of the cereals, besides being profitable in themselves. The effect of green rye or vetch, or both together, plowed under before seeding wheat has also been very great on the following wheat crop. Data in Department Bulletin 156.

Assignment.—M. A. Carleton, L. C. Aicher, J. W. Jones, D. E. Stephens.

Proposed expenditures, 1915–16.—Cost is included in the field-station projects.

CEREAL-DISEASE INVESTIGATIONS.

Cereal-Rust Investigations:

Object.—(1) To study the rust resistance of cereals and of wheat in particular; (2) to conduct cereal-breeding experiments for the purpose of producing rust-resistant varieties; (3) to study the physiology and morphology of cereal rusts and related forms; (4) to determine the relation of rusted seed to rust epidemics; and (5) to obtain data on geographic distribution and spore migration of the rusts.

Procedure.—(1) Greenhouse and nursery cultures of a number of varieties of wheat and other small grains are conducted to determine the relative resistance of each and the relation of growth factors to infection. (2) Extensive hybridization and selection experiments are conducted in the field nursery at St. Paul, Minn. Rust-resistant durum wheats and other resistant varieties are crossed on varieties noted chiefly for milling and bread-making qualities to obtain good all-purpose and rust-resistant strains. (3) The physiology and chemistry of infection are studied to obtain more data on the physiologic behavior of host plant and of host tissues when subject to invasion by the rust organism. (4) More precise knowledge of the relation of growth factors will be obtained through the use of radioatmometers and more refined methods of recording relative humidity, soil and atmospheric temperatures, wind movement, etc. Because of the recent rust epidemic in the Northwest these investigations will be greatly increased and the following additional work will be undertaken: (1) An exhaustive study of the rust-in-seed problem; (2) extensive field observations and studies in North Dakota, South Dakota, Minnesota, Kansas, and wheat-producing sections elsewhere in the United States; (3) a continuation and intensification of studies on the relationships of the rusts of grasses to cereal crops and vice versa; (4) laboratory and greenhouse studies on the water requirements of rust-infected wheat and oat plants of various varieties; and (5) further studies on the cytology of infection.

Cooperation.—State experiment stations of Minnesota, Iowa, Kansas, and New York (Cornell).

Location.—Washington, D. C.; St. Paul and Crookston, Minn.; Manhattan, Kans.; Ames, Iowa; Knoxville, Tenn.; Ithaca, N. Y.; Akron, Colo.; Brookings, S. Dak.; and field stations of the Office of Cereal Investigations.

Cereal-Rust Investigations—Continued.

Date begun.—1894.

Results.—Data published in V. P. & P. Bulletin 16, and B. P. I. Bulletins 63, 216, and 224; additional data secured on the question of rust-resistant hybrids now in manuscript and about to be submitted for publication as a Department Bulletin. Considerable work has been done relative to the influence of meteorologic factors on the development of rust epidemics. Extensive milling and baking tests have been made with reference to a number of rust-resistant hybrids.

Assignment.—H. B. Humphrey, John H. Parker.

Proposed expenditures.—$6,420.

Investigations of the Smuts of Corn, Sorghum, and Broom Corn:

Object.—To investigate the life histories and physiology of the smuts of corn, sorghums, and broom corn; devise methods of control and secure information pertaining to the distribution and economic importance of these smuts.

Procedure.—Field and laboratory experiments are carried on to determine physiologic behavior of host to parasite and vice versa; field and greenhouse cultures to ascertain unknown or obscure facts concerning life history of corn smut; experiments with various soil fungicides and sprays.

Cooperation.—Minnesota and Kansas experiment stations.

Location.—Washington, D. C.; Mitchell, Nebr.; Manhattan, Kans.; St. Paul. Minn.; and Amarillo, Tex.

Date begun.—1906.

Results.—Kernel smut of sorghum has been found to be preventable; B. P. I. Circular 8. The life history of head smut of sorghum has been made known and results of research published in Journal of Agricultural Research under the title "Head Smut of Sorghum and Maize," 1914: also a paper in Phytopathology under the title, "Loose Kernel Smut of Sorghum," 1915. Interesting data have been obtained bearing on the method of infection and physiology of corn smut.

Assignment.—H. B. Humphrey, A. A. Potter.

Proposed expenditures, 1915–16.—$3,310.

Investigations of the Smuts of Small Grains:

Object.—To investigate the physiology and distribution of the smuts of small grains, determine incompletely known facts pertaining to their life histories. and improve present methods of smut control and devise new ones.

Procedure.—Bunt or stinking smut: To continue a series of outlined field experiments to determine the necessary length of rotation period for prevention of bunt in Pacific Northwest; conduct further laboratory and field experiments to determine accurately the influence of soil moisture and soil temperature on infection of wheat by bunt organism; and study by chemical analysis the chemistry of infection. This will involve an effort to extract the catalytic (or other) enzym which may be active in assisting infection.

Loose smuts of wheat and barley: There is now being made a careful experimental study of the process of infection in order that better control of infection may be had in the artificial inoculation of material for microscopic study and that work on the subject of control measures may be facilitated through seed selection. To develop practicable means of control, curves integrating the factors of time and temperature in the death point of cereals and of the fungus within the seed are being plotted on the basis of a single prolonged hot-water treatment between 40° and 50° C. These data are to be used in producing a mechanical device that will automatically integrate the two factors. Other methods of prevention are being studied.

Oat smuts: These are being studied with a view to a better understanding of their distinctions in field and artificial cultures and in life history. The application of these results to a critical study of the immunity of Burt oats is projected.

Cooperation.—Minnesota, Kansas, and Washington experiment stations.

Location.—Washington, D. C.; St. Paul, Minn.; Manhattan, Kans.; Pullman. Wash.; and cereal field stations.

Date begun.—1890.

Investigations of the Smuts of Small Grains—Continued.

Results.—Methods of prevention of bunt or stinking smut of wheat, covered smut of barley, and oat smut worked out; estimated annual preventable loss, $38,000,000; data in B. P. I. Bulletin 152, Department Bulletin 30. and Farmers' Bulletins 219 and 507. Loose smut of rye was discovered in 1913 and is now under investigation. Additional data have been recorded on influence of soil temperature and soil moisture on infection of wheat by the stinking-smut organism, and on crop rotation as a means of controlling stinking smut in the Pacific Northwest.

Assignment.—H. B. Humphrey, A. A. Potter.

Proposed expenditures, 1915–16.—$2,060.

Miscellaneous Cereal Diseases:

Object.—(1) To determine the prevalence and economic importance and to investigate the life histories and methods of control of the disease-producing fungi common to rice and other minor cereal crops; (2) to investigate Fungi Imperfecti known to cause diseases of economic importance on cereals, and to devise methods of control.

Procedure.—Diseases of rice: Carefully conducted field, greenhouse, and laboratory experiments relating to the physiology, life history, and control of the rice-blast organism, *Piricularia grisca*, are made; also field and laboratory experiments to determine the possible relation of certain fungi to straight-head disease and to seedling blight.

Diseases of barley: Continued cooperation with the Wisconsin Experiment Station on the Helminthosporium diseases of barley. Studies will cover the life histories and habits of the several organisms; cardinal temperature, physiology of infection, methods of control by means of formalin and other fungicides, distribution and economic importance of each of the three diseases, and relation of the causative organisms to other cereals and to wild and cultivated grasses.

Diseases of other cereals induced by Fungi Imperfecti: Each of several Fungi Imperfecti isolated from diseased wheat, oats, rye, flax, and buckwheat are being studied with reference to their economic importance and possible relation to several obscure diseases, some of which have been classified as root diseases. Field and laboratory studies will be conducted to determine the cause of flax canker and to determine facts relative to the physiology and etiology of flax wilt and the Fusarium wilt of buckwheat.

Cooperation.—Wisconsin Experiment Station.

Location.—Washington, D. C.; Madison, Wis.; and cereal field stations.

Date begun.—Rice diseases, 1904; diseases of other cereals induced by Fungi Imperfecti, 1910.

Results.—Two species of Fusarium found with considerable constancy in diseased rice plants have been isolated and studied, and further data on the physiology of *Piricularia grisea* accumulated. Experimental evidence showing susceptibility of wheat and oats to infection has been obtained and the disease induced by species of Helminthosporium and Fusarium has been isolated from diseased plants received from different parts of the country. Paper, entitled "A Study of Some Imperfect Fungi Isolated from Wheat, Oat, and Barley Plants," published in the Journal of Agricultural Research, 1914.

Assignment.—H. B. Humphrey, G. H. Godfrey.

Proposed expenditures, 1915–16.—$3,910.

Total, Cereal-Disease Investigations, $15,700.

Total, Cereal Investigations, $119,025.

[Research.]

CORN INVESTIGATIONS.

Supervision:

Object.—To make available to the public with special reference to farmers and demonstrational and educational workers the results of research work and to place with reliable cooperators seed of new and improved varieties developed in the course of field investigations; to conduct general office business in connection with corn investigations.

Supervision—Continued.

Location.—Washington, D. C.

Date begun.—1901.

Assignment.—C. P. Hartley.

Proposed expenditures, 1915–16.—$8,220.

Production of Improved Strains of Corn for the Different Geographical Sections of the United States:

Object.—To determine by investigational work efficient methods of corn breeding and their practical application in the improvement of strains of corn under different environments.

Procedure.—Methods of breeding corn are tested with many strains under different environments and accurate records of results maintained. Improved seed and suggestions as to corn improvement were placed with 600 farmers in 46 States in 1915.

Cooperation.—Individual farmers.

Location.—Arlington, Occoquan, and Round Hill, Va.; Oconomowoc, Wis.; Piketon and Sunbury, Ohio; Rhinebeck, N. Y.; Darlington, St. Charles, and Lykesland, S. C.; Clarksdale, Miss.; Marshall and Waco, Tex.; Chico, Cal.; Walthill, Nebr.; Charleston and St. Charles, Mo.; Morrell, Stuttgart, and Armorel, Ark.

Date begun.—1900.

Results.—Certain methods of corn breeding have been demonstrated to be practicable commercially; variation of methods with different environments necessary. Several strains of corn of unusual productivity have been originated or improved and introduced.

Assignment.—C. P. Hartley, E. B. Brown, C. H. Kyle, J. G. Willier, F. D. Richey, G. J. Burt, H. S. Garrison, H. M. Steece, C. D. Bennett, H. H. Biggar.

Proposed expenditures, 1915–16.—$11,000.

Corn Improvement with Reference to Corn Products:

Object.—To develop types better suited to specific purposes in the manufacture of corn products; to determine methods of breeding, curing, and storage that will improve the popping qualities and wholesomeness of popcorn.

Procedure.—Comparative tests of the desired qualities are made, and isolated breeding plats planted from seed having these qualities most fully developed are maintained.

Cooperation.—Individual farmers, domestic-science schools, millers, and manufacturers.

Location.—Washington, D. C.; Oconomowoc, Wis.; Piketon, Ohio; Niles and Vicksburg, Mich.

Date begun.—1910.

Results.—Data upon the culinary properties and palatability of meal made from different types of corn and from the same type by different processes; data on pop corn contained in Farmers' Bulletins 553 and 554.

Assignment.—C. P. Hartley, J. G. Willier.

Proposed expenditures, 1915–16.—$2,000.

Study of Hereditary and Environmental Effects:

Object.—To investigate the effects of inheritance and environment upon the plant and to determine general laws governing them; to develop and improve methods of corn breeding based upon the results of these studies.

Procedure.—The same variety or strain tested under different environments and different varieties and strains tested under same environments.

Cooperation.—Individual farmers.

Location.—Observations throughout the United States; experimental plats located in New York, Virginia, South Carolina, Georgia, Mississippi, Louisiana, Texas, Arkansas, Missouri, Ohio, Michigan, Wisconsin, North Dakota, South Dakota, Nebraska, Colorado, Montana, and Nevada.

Date begun.—1901.

Result.—Data secured upon the degree and extent of inheritance of certain characters; the effects of self-fertilization, close breeding, broad breeding, and crossbreeding; data in B. P. I. Bulletin 218.

Assignment.—C. P. Hartley, E. B. Brown, C. H. Kyle, J. G. Willier, F. D. Richey, G. J. Burt, H. S. Garrison, H. M. Steece, C. D. Bennett, H. H. Biggar.

Proposed expenditures, 1915–16.—$10,000.

Seed-Corn Selection, Fumigation, Drying, and Preservation:

Object.—To develop and improve methods of seed-corn selection, fumigation, drying, and preservation.

Procedure.—Different methods of selection, fumigation, drying, and preservation are tested in different environments.

Cooperation.—Individual farmers.

Location.—Arlington, Occoquan, and Round Hill, Va.; Oconomowoc, Wis.; Piketon and Sunbury, Ohio; Rhinebeck, N. Y.; Darlington, St. Charles, and Lykesland, S. C.; Clarksdale, Miss.; Marshall and Waco, Tex.; Chico, Cal.; Walthill, Nebr.; Charleston and St. Charles, Mo.; Morrell, Stuttgart, and Armorel, Ark.; Niles, Vicksburg, and Ravenna, Mich.

Date begun.—1901.

Results.—Valuable methods have been developed and are now in practice in many corn-growing sections; methods must be modified to meet different environmental conditions.

Assignment.—C. P. Hartley, E. B. Brown, C. H. Kyle, J. G. Willier, F. D. Richey, G. J. Burt, H. S. Garrison, H. M. Steece, C. D. Bennett, H. H. Biggar.

Proposed expenditures, 1915–16.—$9,000.

Methods of Corn Culture:

Object.—To improve and develop methods of corn culture; to determine the fundamental principles that control stalk growth and grain production; to study the relation to stalk growth and grain production of the moisture content of the soil, the physical condition of the soil, methods of planting, cultivation, rotation, and fertilization.

Procedure.—Similar experimental tests conducted in different environments by united efforts of the scientific forces.

Cooperation.—Individual farmers.

Location.—Observation throughout the United States; experimental plats located in New York, Virginia, South Carolina, Georgia, Mississippi, Louisiana, Texas, Arkansas, Missouri, Ohio, Michigan, Wisconsin, North Dakota, South Dakota, Nebraska, Colorado, Montana, and Nevada.

Date begun.—1901.

Results.—Data accumulated upon factors influencing stalk growth and grain production; methods of rotation, planting, cultivation, and fertilization developed for different environments.

Assignment.—C. P. Hartley, E. B. Brown, C. H. Kyle, J. G. Willier, F. D. Richey, G. J. Burt, H. S. Garrison, H. M. Steece, C. D. Bennett, H. H. Biggar.

Proposed expenditures, 1915–16.—$3,000.

Total, Corn Investigations, $43,220.

[Research.]

TOBACCO INVESTIGATIONS.

Supervision:

Object.—To provide for administrative and clerical routine, including correspondence, preparation of reports and manuscripts, and other general details connected with the field and laboratory investigations.

Location.—Washington, D. C.

Date begun.—1909.

Assignment.—W. W. Garner.

Proposed expenditures, 1915–16.—$7,205.

New England Cigar-Wrapper Tobacco Investigations:

Object.—To develop principles and methods of breeding, growing, curing, and handling cigar-wrapper tobacco; to study the relation of environment to the development of the tobacco plant.

Procedure.—Native tobacco is crossed with Cuban and Sumatra varieties and the character and behavior of hybrids studied. The behavior of tobacco under different soil and climatic conditions and under different curing conditions is investigated.

Cooperation.—Connecticut Experiment Station and Harvard University.

Location.—Suffield and Tariffville, Conn.

Results.—A method of curing cigar leaf with artificial heat has been developed which eliminates large annual losses to New England growers;

New England Cigar-Wrapper Tobacco Investigations—Continued.

methods of breeding applicable to the improvement of tobacco developed. Two of the new types of wrapper leaf are proving very valuable.

Date begun.—1903.

Probable date of completion.—1917.

Assignment.—E. G. Beinhart, E. M. East.

Proposed expenditures, 1915–16.—$2,300.

Maryland Export Tobacco Investigations:

Object.—To improve the crop by breeding and selection, determine the best use of fertilizers for tobacco, develop the best systems of rotation adapted to tobacco, and develop improved methods of growing, curing, and handling tobacco.

Procedure.—Pure strains of native tobacco varieties are developed by systematic selection, and new types are produced by crossing native and related foreign varieties, followed by careful selection. Plat tests are carried out to determine the proper kind and quantity of commercial fertilizers to obtain best results with tobacco. Field experiments are conducted with systems of crop rotation specially adapted to restoring the depleted humus supply of the tobacco soils.

Cooperation.—Maryland Experiment Station.

Location.—Upper Marlboro, Md.

Date begun.—1905.

Results.—A new type of leaf produced by breeding is becoming very popular with growers and is already being grown quite extensively. It has been found that the fundamental need of the tobacco soils is an increased supply of vegetable matter and that nitrogen is the limiting element of plant food. It has been shown that the growing of soil-improving crops, combined with liming the soil, greatly improves the yield of the tobacco crop.

Probable date of completion.—1918.

Assignment.—D. E. Brown.

Proposed expenditures, 1915–16.—$1,400.

Burley Tobacco Investigations:

Object.—To develop and test pure strains of standard Burley varieties, to determine fertilizer requirements and best systems of crop rotation for Burley tobacco, and to develop better cultural and curing methods.

Procedure.—The more important varieties of Burley tobacco are subjected to comparative tests as to yield and quality, and pure strains of the better varieties are developed by seed selection. Tests with fertilizers and systems of crop rotation for Burley tobacco are carried out on sets of field plats. In the curing work, experimental curings are made in a specially constructed barn fitted with facilities for applying artificial heat. More attention will be given to fertilizer and rotation tests and curing problems.

Cooperation.—Kentucky and West Virginia experiment stations.

Location.—Milton, W. Va., and Lexington, Ky.

Date begun.—Kentucky, 1906; West Virginia, 1913.

Results.—Varieties of Burley tobacco have been tested, and seed of pure strains of the best varieties are being distributed. Experiments in curing Burley tobacco with artificial heat indicate that more desirable colors can be obtained in this way. In the Burley section of West Virginia there is a decided need for the introduction of better methods of growing and handling the tobacco crop.

Probable date of completion.—1919.

Assignment.—C. H. Scherffius.

Proposed expenditures, 1915–16.—$1,000.

Western Fire-Cured Tobacco Investigations:

Object.—To determine the fertilizer requirements and best systems of crop rotation for this type of tobacco; to develop better cultural methods for producing fire-cured tobacco.

Procedure.—In order to develop methods for increasing the yield and maintaining good quality for the dark fire-cured tobacco, field-test plats are arranged to bring out the most profitable use of fertilizers when combined with closer planting of the tobacco. A number of different systems of crop rotation are being tried out, all of which include tobacco as the leading money crop and one or more soil-improving crops.

Western Fire-Cured Tobacco Investigations—Continued.

Cooperation.—Kentucky and Tennessee experiment stations.

Location.—Clarksville, Tenn., and Hopkinsville, Ky.

Date begun.—Kentucky, 1906; Tennessee, 1912.

Results.—More intensive methods and a restricted acreage for tobacco and further diversification of crops are required in these districts. It has been demonstrated that a more rational use of fertilizers combined with better cultural methods would increase the acre value of the tobacco crop 50 per cent.

Probable date of completion.—1919.

Assignment.—R. H. Milton.

Proposed expenditures, 1915–16.—$1,400.

New York Binder and Filler Tobacco Investigations:

Object.—To develop improved types of tobacco by seed selection, determine the most profitable use of fertilizers for the tobacco crop, and introduce systems of crop rotation adapted to the culture of binder and filler leaf.

Procedure.—Fertilizer tests with tobacco are conducted on a series of field plats. In the crop-rotation experiments the comparative merits of several different systems of rotation for tobacco culture are being tried out. Seed selection with the standard native varieties of tobacco is practiced with a view to obtaining improved strains. Special attention will be given to the fertilizer and crop-rotation tests.

Cooperation.—New York (Geneva) Experiment Station.

Location.—Baldwinsville and Big Flats, N. Y.

Date begun.—1907.

Results.—Information has been obtained as to the comparative values of different kinds and quantities of nitrogenous, phosphatic, and potash fertilizers for the filler leaf. In the rotation plats the relative profitableness of three rotation systems for tobacco has been tested. Some of the plats have yielded more than 2,000 pounds of tobacco per acre. A phase of the investigations which has been of special interest to growers has to do with the growing of cover crops adapted to tobacco culture.

Probable date of completion.—1918.

Assignment.—G. W. Harris.

Proposed expenditures, 1915–16.—$1,750.

Sun-Cured, Fire-Cured, and Flue-Cured Tobacco Investigations:

(*a*) SUN-CURED, FIRE-CURED, AND FLUE-CURED TOBACCO INVESTIGATIONS IN VIRGINIA:

Object.—To determine more profitable methods of fertilizing the tobacco crop, develop systems of rotation adapted to tobacco culture, and improve present cultural methods.

Procedure.—Local stations are maintained in the three principal tobacco districts for carrying out experiments with fertilizers and cultural methods.

Cooperation.—Virginia Experiment Station.

Location.—Appomattox, Chatham, and Bowling Green, Va.

Date begun.—1907.

Results.—Accurate information obtained as to more profitable methods of handling the tobacco crop and tobacco soils, especially as to use of fertilizers and rotation of crops.

Probable date of completion.—1917.

Assignment.—E. H. Mathewson.

Proposed expenditures, 1915–16.—$1,325.

(*b*) FLUE-CURED TOBACCO INVESTIGATIONS IN NORTH CAROLINA:

Object.—To develop better tobacco varieties for flue curing; to improve fertilizer, rotation, cultural, and curing methods; to devise methods for the control of Granville wilt.

Procedure.—Field experiments are conducted on leased lands at Reidsville and Creedmoor, N. C., and long-term experiments on a permanent location owned by the State at Oxford. In work on rotation special attention is given to the use of soil-improving crops not injurious to the quality of tobacco. Special barns are used in the curing work. The control of Granville wilt, based on breeding resistant varieties and use of immune crops in systems of rotation, will be undertaken.

Cooperation.—North Carolina Experiment Station.

Sun-Cured, Fire-Cured, and Flue-Cured Tobacco Investigations—Continued.

Location.—Creedmoor, Oxford, and Reidsville, N. C.

Date begun.—1909.

Results.—Improved fertilizer and cultural and curing methods for tobacco worked out and methods of controlling Granville wilt and leaf-spot developed.

Assignment.—E. H. Mathewson, E. G. Moss.

Proposed expenditures, 1915–16.—$4,140.

(*c*) FLUE-CURED TOBACCO INVESTIGATIONS IN SOUTH CAROLINA:

Object.—To test and improve by selection standard varieties of tobacco, and to determine the best methods of fertilizing and culture.

Procedure.—Plat experiments with fertilizers, systems of rotation adapted to tobacco, and improved cultural methods are carried out on leased land for a series of years.

Cooperation.—Local boards of trade and farmers.

Location.—Timmonsville and Manning, S. C.

Date begun.—1910.

Results.—Better methods of fertilizing and growing the crop and of rotating soils for tobacco have been developed.

Probable date of completion.—1919.

Assignment.—E. H. Mathewson, J. P. Young.

Proposed expenditures, 1915–16.—$3,100.

Pennsylvania Cigar-Filler Tobacco Investigations:

Object.—To improve the yield and quality of cigar-filler and binder leaf by breeding and selection, and the development of better methods of growing, curing, and handling.

Procedure.—Selected strains of standard filler and binder varieties are tested as to yield and quality, fertilizer plat tests for improving the burning qualities and the yield of tobacco are carried out, and new cultural and curing methods are investigated. The seed-selection and fertilizer tests will be continued and more attention will be given to curing methods.

Cooperation.—Pennsylvania Experiment Station.

Location.—Landisville and Lock Haven, Pa.

Date begun.—1910.

Results.—Two new strains have been developed which give high yields and desirable quality; poor burning qualities shown to be due largely to use of improper fertilizers; steam sterilization of seed beds introduced and improved cultural methods developed.

Probable date of completion.—1919.

Assignment.—Otto Olson.

Proposed expenditures, 1915–16.—$2,800.

Miscellaneous Tobacco Investigations:

Object.—To study the physiology, pathology, and chemistry of the tobacco plant in their relation to improved methods of growing, curing, fermenting, and handling the crop. This work supplies the fundamentals for the practical work in improving methods of tobacco production.

Procedure.—Work is carried on in laboratory, greenhouse, and field. The nature of the ripening, curing, and fermentation processes, the optimum conditions required, and the diseases met with are investigated. Causes of poor burning qualities and other properties are studied through chemical analyses and histological examination. Mosaic and other important diseases are studied by laboratory and greenhouse methods. The ripening fermentation processes will receive special attention during the coming year.

Location.—Arlington, Va., and Washington, D. C.

Date begun.—1906.

Results.—Important improvements in curing methods developed; factors governing formation of nicotine in the tobacco plant ascertained; study of the effects of soil and climate on the growing crop has been of the greatest value in developing improved methods of production; important information obtained on the nature of the mosaic disease.

Assignment.—W. W. Garner.

Proposed expenditures, 1915–16.—$2,720.

Total, Tobacco Investigations, $29,140.

[Research.]

PAPER-PLANT INVESTIGATIONS.

Paper-Plant Investigations:

Object.—To investigate the value and suitability for paper-making purposes of various wild and cultivated plants and crop wastes; relevant paper-making processes and their application to such materials; the availability of these materials, and the conditions under which they are produced and assembled for market; to breed such plants as may have a paper-making value.

Procedure.—Chemical and physical investigation of plants are conducted to ascertain the best method of treatment; laboratory work in the manufacture of sample sheets of paper to demonstrate value of process and product; paper-making tests on a large scale, in cooperation with manufacturers, to demonstrate the value of materials under commercial conditions of manufacture; field investigations regarding availability of materials and agricultural and assembling conditions. The proposed work on flax straw embraces tests on flax-tow manufacture, with a view to producing a better and cheaper product for use in making paper and fiber board. Arrangements are being made to raise and breed plants for paper-making tests on the experimental farm at Arlington, Va.

Cooperation.—Bureau of Chemistry; Forest Service; Bureau of Standards, Department of Commerce; and cooperative mill tests with commercial companies at Cumberland Mills and Bar Mills, Me., Bridgeport, Pa., St. Paul, Minn., Aurora, Ill., Monroe, Mich., and Appleton, Wis.

Location.—Washington, D. C.; mill tests as shown under "Cooperation"; field investigations at Brownsville, Del Rio, and El Paso, Tex., Deming, N. Mex., Tucson, Ariz., Los Angeles and Chico, Cal., and Aneta, N. Dak.

Date begun.—1907.

Results.—In cooperative mill tests satisfactory and merchantable paper has been manufactured from cornstalks, broom corn, hemp stalks, hemp flyings, *Epicampes macroura*, and *Yucca treculeana*. Merchantable counterboard has been manufactured from domestic flax tow and sold to the trade at market price; this is used extensively in shoe manufacture. A publication has been prepared on the paper-making value of *Epicampes macroura*, which will be printed on paper manufactured from this material during experiments. A publication has been prepared on paper and fiber board manufactured from flax straw and tow. A modified process of treating flax straw has been devised and patent requested.

Assignment.—Charles J. Brand, Jason L. Merrill.

Proposed expenditures, 1915–16.—$13,000.

[Research.]

ALKALI AND DROUGHT RESISTANT PLANT INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—To execute administrative affairs and conduct correspondence and laboratory work in connection with investigational projects.

Location.—Washington, D. C.

Date begun.—1907.

Assignment.—T. H. Kearney.

Proposed expenditures, 1915–16.—$6,470.

BREEDING AND PHYSIOLOGY OF ALKALI AND DROUGHT RESISTANT PLANTS.

Investigating the Alkali Resistance of Crop Plants:

Object.—To ascertain by laboratory investigations and by field observations the relative adaptability of crop plants to alkali soils and to study the physiological effects of alkali as a basis for the more scientific handling of crops grown on such soils.

Procedure.—Observations are made in the field upon different crop plants growing in alkali soils, in order to ascertain how the alkali affects them and to determine what species and varieties are most resistant. Determinations of the kind and quantity of salts present are made in this connection. Such observations form the basis for recommendations of

Investigating the Alkali Resistance of Crop Plants—Continued.

crop plants adapted to growing on alkali soils. These observations are supplemented by experiments in the greenhouse upon plants grown in the presence of the different salts which occur in natural alkali soils, and the effect of these salts upon the structure and physiological functions of the plants is thus determined under carefully controlled conditions.

Location.—Laboratory work at Washington, D. C.; field work at various points in the States of Arizona, California, Nevada, Utah, Colorado, and other Western States where irrigation is extensively practiced.

Date begun.—1907.

Results.—The results of several years' investigation of the comparative alkali resistance of different crop plants and practical recommendations regarding what crops to grow on alkali land have been summarized and published in Farmers' Bulletin 446. During the past year further studies have been made of the effect of alkali upon the water requirement of wheat and alfalfa. The results indicate that in the case of both crops the quantity of water required to produce a given weight of dry matter is greater in a soil containing much alkali than in a nonalkali soil.

Assignment.—T. H. Kearney.

Proposed expenditures, 1915–16.—$1,000.

Investigating the Physiology of Drought Resistance:

Object.—To investigate the function and structure of crop plants in order to determine causes of superior resistance of certain species and varieties to drought and to furnish a physiological basis for plant breeding, variety testing, and investigations of cultural methods.

Procedure.—Field observations are made upon the structure and functions of crop plants when the water supply is deficient. Measurements are made of the quantity of water used by the different species and varieties in producing a given weight of dry matter, in order to determine their relative efficiency in the use of water. The results of these observations and experiments make it possible to determine the comparative drought resistance and the adaptability to dry-land agriculture of the different crop plants.

Location.—Laboratory work at Washington, D. C.; field work at experiment farms of Bureau of Plant Industry at Akron, Colo., Moro, Oreg., Newell and Ardmore, S. Dak., Amarillo, Tex., and Arlington, Va.

Date begun.—1908.

Results.—Crops differ widely in the amount of water required to produce a unit weight of dry matter. The water requirement is determined largely by the climatic conditions under which they are grown. Differences in soil-moisture content do not materially affect the water rerequirement. The transpiration rate has been determined by continuous automatic measurements for many crops, principally alfalfa, rye, wheat, oats, sorghum, and amaranthus, and correlated with solar radiation, air temperature, saturation deficit, evaporation rate, and wind velocity. The loss of water from seedtime to harvest was also determined by daily weighings. By correlating the transpiration, evaporation, temperature, saturation deficit, solar radiation, and wind velocity it seems probable that the relative effects of these various factors on transpiration can be stated with considerable exactness. Important results have also been obtained by the study of root distribution. Publications: "Relative Water Requirement of Plants," Journal of Agricultural Research, vol. 3, No. 1; "Effect of Frequent Cutting on the Water Requirement of Alfalfa and Its Bearing on Pasturage." Department Bulletin 228; a manuscript on "The Influence of Hybridization and Cross-Pollination on the Water Requirement of Plants," submitted for publication in the Journal of Agricultural Research.

Assignment.—H. L. Shantz.

Proposed expenditures, 1915–16.—$7,040.

Indicator Value of Native Vegetation in Arid Regions:

Object.—To work out methods for utilizing native vegetation in classifying new land as to its agricultural value by establishing correlations between different types of natural growth and the soil moisture and alkali conditions of the corresponding types of land.

Indicator Value of Native Vegetation in Arid Regions—Continued.

Procedure.—In a given area the different types of native vegetation are classified and the character of the land upon which each type occurs is determined, special attention being given to the moisture relations and salt content of the soil. If crops are being grown, the yield and behavior of the cultivated plants are studied in order to correlate the crop-producing capabilities of the land with the kind of native growth which it originally produced. When these correlations have been worked out in detail in a limited area it becomes possible to classify land with respect to its agricultural capabilities throughout the region where these particular types of vegetation occur.

Location.—Arid and semiarid portions of United States—Great Plains and Great Basin regions.

Date begun.—1910.

Results.—During the past season work on this project has been carried on in southwestern Utah, southern Nevada, southern California, and southern Arizona. In all these localities the native vegetation was found to be indicative of whether the land is or is not suitable for dry farming and whether or not alkali is present in quantity sufficient to injure crop plants under irrigation.

Probable date of completion.—Sufficient work has been done in the Great Plains and Great Basin and in the southwestern desert region to demonstrate the practicability of classifying land in these regions by the indicator-plant method. Further inventigations in the Columbia River region and in New Mexico are desirable in order to determine the applicability of the method throughout the more arid portions of the United States. Whether active work under this project will continue thereafter will depend largely upon whether this method is adopted by national or other agencies which are charged with the practical work of land classification.

Assignment.—T. H. Kearney, H. L. Shantz.

Proposed expenditures, 1915–16.—$1,660.

Breeding Drought-Resistant Field Crops:

Object.—To work out methods for breeding more drought-resistant strains of field crops adapted to dry-land agriculture and to devise improved methods of testing comparative drought resistance.

Procedure.—Individual plants are selected which give indications in their structure and behavior of superior drought resistance, and their progenies are grown in parallel rows and compared with respect to drought resistance, water requirement, productiveness, and general desirability. Those strains which prove to be best adapted to conditions of drought without impairment of other valuable qualities are chosen for distribution to farmers through the Office of Seed Distribution.

Location.—Newell and Ardmore, S. Dak.; Akron, Colo.; and Mandan, N. Dak.

Date begun.—1908.

Results.—Improved drought-resistant strains of millet, sorgo, and alfalfa adapted to the northern and central Great Plains have been secured. Distribution to farmers of seed of some of these strains has been made. Improved methods have been worked out for testing comparative drought resistance in connection with plant-breeding work. A manuscript on "Breeding Millet and Sorgo for Drought Resistance" has been submitted for publication as a Department Bulletin.

Assignment.—T. H. Kearney, A. C. Dillman.

Proposed expenditures, 1915–16.—$2,780.

Breeding and Culture of Pomegranates:

Object.—To obtain by introduction and breeding drought-resistant and alkali-resistant varieties of pomegranates.

Procedure.—Through the Office of Foreign Seed and Plant Introduction promising varieties of pomegranates have been introduced from various foreign countries and are being tested side by side at a number of stations in the southwestern United States. The different varieties are compared with respect to their adaptability to the local climatic and soil conditions, their yield, and the size and quality of their fruit. Those which give the best results are propagated for distribution to growers in the region to which they have proved adapted.

Breeding and Culture of Pomegranates—Continued.

Location.—Sacaton, Ariz.; Bard and Indio, Cal.; San Antonio, Tex.; and Washington, D. C.

Date begun.—1907.

Results.—Pressure of other work prevented much progress on this project during the past year. Some work was done in the selection of desirable seedlings at Bard, Cal., and Sacaton, Ariz., and a small distribution of imported varieties was made to growers in the Southwest.

Assignment.—T. H. Kearney.

Proposed expenditures, 1915–16.—$500.

Total, Breeding and Physiology of Alkali and Drought Resistant Plants. $12,980.

EGYPTIAN COTTON BREEDING.

Egyptian Cotton Breeding and Alkali-Resistance Investigations in the Arid Southwest:

Object.—To secure varieties of Egyptian cotton yielding fiber of superior quality and thoroughly adapted to growing under irrigation in the southwestern United States.

Procedure.—The usual methods of plant breeding are followed. The most promising strains are tested on a field basis, and seed of the one which yields best and of which the fiber gives the best results in spinning tests is distributed to farmers. Studies are made of the behavior of the plants on soils having different salt content and different moisture conditions, in order to ascertain what soils are best adapted to this crop. Plant-breeding work is carried on at the bureau cooperative testing gardens on the Pima Indian Reservation, Sacaton, Ariz.

Cooperation.—Cooperative cotton growers' organizations.

Location.—Sacaton, Ariz., and throughout the Salt River Valley.

Date begun.—1907.

Results.—In cooperation with the Salt River Valley Egyptian Cotton Growers' Association several fields of the Yuma variety were rogued last summer, and the resulting seed will be increased during the present year in order to supply the seed for general commercial planting in 1916. The new Pima variety, having fiber 1⅜ to 1¾ inches long, was grown on a field scale, and sufficient fiber was produced for a spinning test. Plant-breeding work with this variety has been continued and seed of the best strain is being increased, so that in case it should be decided to substitute this variety for the Yuma in commercial culture in Arizona a large supply of uniform and high-grade seed will be available for planting, and the change from one variety to another can be made by the community at one time. Publications: "Seed Selection of Egyptian Cotton," Department Bulletin 38; "Mutation in Egyptian Cotton," Journal of Agricultural Research, vol. 2, No. 4.

Assignment.—T. H. Kearney.

Proposed expenditures, 1915–16.—$5,550.

Total, Alkali and Drought Resistant Plant Investigations, $25,000.

[Research.]

SUGAR-BEET INVESTIGATIONS.

Supervision:

Object.—To administer the funds, handle correspondence, keep all records, and give general oversight to the field, laboratory, and office work.

Location.—Washington, D. C.

Date begun.—1914.

Assignment.—C. O. Townsend.

Proposed expenditures, 1915–16.—$4,560.

Economic Practice in Crop Production in Sugar-Beet Areas:

Object.—To determine what relations, if any, exist between the sugar-beet and the other farming and live-stock operations now existing in a given territory.

Procedure.—An economic farm-to-farm survey covered by the original survey plus the survey covering the production, buying, marketing, and other factors bearing directly or indirectly upon the possible new lines of agriculture is made. The relation of each crop to the other, as

Economic Practice in Crop Production in Sugar-Beet Areas—Continued.

well as to the live stock on the farm, and also its relation to the market conditions, is studied. Cooperation of the best farmers in each community is secured in doing those things that will lead to the best system of crop rotation and live-stock production, with a view to establishing an improved, permanent, and progressive agriculture. In case of radical changes in local agricultural methods or crop production, specific demonstrations may be necessary to accomplish the desired result.

Cooperation.—Bureaus of Chemistry and Animal Industry, Office of Farm Management, farmers' organizations, sugar companies, and individual farmers.

Location.—Chino, Huntington Beach, Santa Ana, and Betteravia, Cal.; Lehi, Utah; Idaho Falls, Idaho; Billings, Mont.; Fort Collins, Fort Morgan, Greeley, and Rocky Ford, Colo.; Blissfield, Mich.; Toledo, Ohio; and other points in the States mentioned.

Date begun.—1914.

Results.—Several hundred individual farm records have been secured.

Assignment.—C. O. Townsend.

Proposed expenditures, 1915–16.—$12,470.

Investigation of the Status of the Sugar-Beet Industry in the United States:

Object.—To determine the present status of the sugar-beet industry in each general locality where the industry now exists; to determine what the limiting factor or factors for sugar-beet production are in each sugar-beet center; to determine whether or not the limiting factor or factors, so far as sugar-beet growing is concerned, are surmountable or insurmountable from an economic standpoint.

Procedure.—An economic farm-to-farm and factory survey is made of the sugar-beet centers, in which all the factors, both direct and indirect, that have any bearing upon sugar-beet growing, harvesting, and delivery are considered and given their proper value, with due regard to the place and value of other crop and live-stock interests on the farm as a unit and the community as a whole.

Cooperation.—Office of Farm Management, sugar companies, and individual farmers.

Location.—States of California, Colorado, Idaho, Michigan, Ohio, Utah, Wisconsin, Indiana, Illinois, Minnesota, Nebraska, Kansas, and Montana.

Date begun.—1914.

Results.—A general survey has been made and some of the limiting factors, with the methods of control, noted.

Assignment.—C. O. Townsend.

Proposed expenditures, 1915–16.—$12,465.

Sugar-Beet Seed Production:

Object.—(1) To determine the conditions under which an adequate supply of sugar-beet seed may be produced in this country in an emergency; (2) to determine the conditions under which commercial beet-seed production may be made a permanent part of our agricultural operations, thereby insuring a stable agriculture for those sections in which sugar beets appear to be vital to the best interests of the farmer; (3) to determine the correlation between the external character of the beet and the quality (sugar, purity, and yield) of the root; (4) to breed out a line of beets in which the quality (sugar, purity, and yield) of the roots will correspond to one or more well-defined external characters of leaf and root, with due regard to quality and yield of seed. Cooperation will be maintained with the Bureau of Chemistry and with other offices of the Bureau of Plant Industry, with State experiment stations, sugar companies, seedmen, and farmers in order to accomplish the desired results most quickly, economically, and effectively.

Procedure.—(1) Advise and assist, so far as practicable, the beet growers, sugar companies, and seedsmen in the various steps needed in commercial beet-seed production in the shortest possible time. This involves all the steps from the selection and storing of the roots on a large scale to the harvesting and cleaning of the mature seed. (2) Study the conditions under which a paying crop of satisfactory beet seed may be produced commercially each year, and determine the relation of soil and climatic conditions, methods of handling the roots, and the influence of pests and other factors on the successful production of commercial sugar-beet seed. (3a) Select from the present known types or strains of sugar

Sugar-Beet Seed Production—Continued.

beets those individuals of distinctive type or character which show the best quality and yield of seed; breed those individuals by the plant-to-row method until the desired type is fixed; that is, until a given type of leaf and root comes true and indicates quality and yield of seed and roots. (3b) Obtain as many types or strains of the wild beet as possible and proceed along the lines indicated above, with the hope of finding a type that will give better results than any of the present domestic types.

In case one type shows quality and another shows yield, crossbreed and develop a new strain combining quality and yield, and from this develop a pure strain having these combined characters. The strains must be widely separated during the season of seed production to keep them pure. Coordinate all the above work so that the production of commercial beet seed for emergency purposes and the determination of the adverse and favorable factors influencing the annual production of the crop shall fit into the economic factors of the improvement of the beet root and the cost of seed production; that is, all this work is to be carried on simultaneously and under such conditions that there will be as little lost motion as possible.

Cooperation.—Bureau of Chemistry, beet-sugar companies, and individual farmers.

Location.—Blissfield, Mich.; Rocky Ford and Fort Collins, Colo.; Lehi and Garland, Utah; Idaho Falls and Sugar City, Idaho.

Date begun.—1915.

Assignment.—W. W. Tracy, jr.

Proposed expenditures, 1915–16.—$3,200.

Total, Sugar-Beet Investigations, $32,695.

[Research.]

SUGAR-CANE SIRUP PRODUCTION.

Sugar-Cane Sirup Production:

Object.—To conduct investigations in connection with the production of table sirup, including the breeding, culture, and diseases of cane, the methods of manufacture, standardization, and marketing of sirup, and the utilization of cane by-products, with special reference to the farm production of cane sirup.

Procedure.—All of the promising standard varieties of sugar cane now used in the sirup belt are being tested in field plats to determine which ones are best adapted to the production of a high quality of sirup. New and promising varieties of cane from Louisiana, Porto Rico, Cuba, and the West Indies will be introduced, especially quick-maturing or good-yielding strains and varieties resistant to root diseases or red-rot and good in rattooning, and these will be tested in the sirup belt after they have been grown for a period of time at quarantine stations to prevent the introduction of serious diseases or insect pests. It is planned to test various methods of culture, types of soil, fertilizers, and crop rotations to determine which are the best and most economical for the production of sugar cane for sirup purposes; to study the diseases of sugar cane and work out methods for their control; to conduct experiments on sugar-cane sirup production, involving the various farm methods of clarifying and filtering sirup and the manufacture of sirup on an experimental scale from the various varieties under different cultural conditions, etc.; and to conduct experiments in the utilization of sugar-cane by-products, such as tops, bagasse, and skimmings.

Cooperation.—Bureau of Chemistry, Wight Realty Co., Cairo, Ga., and individual farmers.

Location.—Cairo, Ga., and points in Florida.

Date begun.—1913.

Results.—No publications have been issued, but some results in spacing and rate of planting, utilization of tops, feeding bagasse, canning experiments, methods of storing the cane, and in variety tests have been obtained.

Probable date of completion.—Three to six years.

Assignment.—C. O. Townsend, P. A. Yoder.

Proposed expenditure, 1915–16.—$6,000.

[Research.]

INVESTIGATIONS IN ECONOMIC AND SYSTEMATIC BOTANY.

SUPERVISION.

Supervision:

Object.—This covers the supervisory and routine work of the office and the laboratory, including the investigations carried on in the greenhouses.

Procedure.—It is part of the duty of the office to furnish the various branches of the department the correct names of plants the identity of which is a matter of importance in their work. For this purpose the office employs expert botanists and maintains a herbarium of cultivated plants (used to supplement the National Herbarium, which is under the Smithsonian Institution).

Cooperation.—National Herbarium.

Location.—Washington, D. C.

Date begun.—1868.

Assignment.—Frederick V. Coville.

Proposed expenditures, 1915–16.—$8,559.

BIBLIOGRAPHICAL WORK IN THE INTEREST OF BOTANICAL SCIENCE.

Bibliographical Work in the Interest of Botanical Science:

Object.—To improve bibliographical facilities for botanical workers in Washington.

Procedure.—A card catalogue, both subject and author, is maintained, which not only represents the resources of the Washington libraries in botany and horticulture but also by the inclusion of entries for books that are needed serves as a guide in the purchase of works in these subjects. Index entries for current scientific serials or society publications are included. A union list of scientific serials or society publications containing botanical or horticultural material is also maintained. A bibliography of horticulture is in process of compilation. An index of botanical illustrations to supplement Pritzel's Icones has just been begun.

Cooperation.—Department library; Library of Congress.

Location.—Washington, D. C., and various large libraries in other cities.

Date begun.—1868.

Assignment.—Marjorie F. Warner, Alice C. Atwood.

Proposed expenditures, 1915–16.—$2,600.

RANGE INVESTIGATIONS.

Range Investigations:

Object.—To develop increased forage in the overgrazed national forests.

Procedure.—Methods are devised for the improvement of wild grazing lands, in cooperation with the Forest Service. This office furnishes expert advice, and most of the details of the investigation are carried on by the Forest Service.

Cooperation.—Forest Service.

Location.—Washington, D. C., and Western States.

Date begun.—1907.

Results.—It has been demonstrated that overgrazed areas can be revegetated without the necessity of closing them to stock, by timing annual grazing to permit seed formation. Sheep fenced in and not herded produce more wool and mutton on less range than by the ordinary methods.

Assignment.—Frederick V. Coville.

Proposed expenditures, 1915–16.—$2,304.

ECONOMIC BOTANY OF NATIVE RACES.

Economic Botany of Mexico, with Special Reference to the Utilization of Valuable Species in the United States:

Object.—To make available for public use information on the useful native plants of Mexico.

Procedure.—This project involves a study of material in the department's economic collection and of all specimens of plants, roots, fruits, or vegetable products submitted for identification; acquisition of supplementary

Economic Botany of Mexico, with Special Reference to the Utilization of Valuable Species in the United States—Continued.

material when necessary and consultation with experts in the various offices of the Bureau of Plant Industry, Forest Service, Bureau of Chemistry, and the United States National Museum, in order to obtain reliable information; correlation of all collectors' notes and statements of those submitting plant products for study with information already published as to the properties of the plants in question; identification of important economic plants, drugs, dyestuffs, resins, balsams, spices, fruits, etc., described by early explorers and writers, with material in our collections; finally, the systematic grouping of these facts and the publication of descriptions of species which prove to be new to science.

Cooperation.—National Herbarium

Location.—Washington, D. C.

Date begun.—1899.

Results.—Publication on classification of the genus Annona; other publications in preparation; general information on economic botany of Mexico for utilization by department workers.

Assignment.—W. E. Safford.

Proposed expenditures, 1915–16.—$2,685.

Plants Used by the American Aborigines:

Object.—To record information possessed by the aborigines regarding the uses of plants.

Procedure.—All available literature on the exploration, early travels, and settlement in this country, as well as publications of a later date that may have a bearing on aboriginal matters, are consulted in various libraries. The information thus found is abstracted and filed under the botanical name of the plant referred to. An index of authors and works consulted is also made.

Cooperation.—National Herbarium.

Location.—Washington, D. C., and Western States.

Date begun.—1891.

Results.—Index and abstracts leading to a series of manuscripts for publication partially completed.

Probable date of completion.—1924.

Assignment.—Frederick V. Coville, Alice Henkel.

Proposed expenditures, 1915–16.—$2,277.

Total, Economic Botany of Native Races, $4,962.

BOTANY OF THE ECONOMIC GRASSES.

Manual of North American Grasses:

Object.—To produce a descriptive manual of the grasses of the United States.

Procedure.—Material is gathered from the region covered and arranged and studied. All possible information from literature is collected. Individual groups of grasses which are finally to be published in monographic form are studied.

Cooperation.—National Herbarium.

Location.—Washington, D. C., and various parts of North America.

Date begun.—1905.

Results.—A mass of information is being accumulated for use in the forthcoming manual.

Probable date of completion.—1924.

Assignment.—A. S. Hitchcock.

Proposed expenditures, 1915–16.—$2,400.

Grass Introduction Index:

Object.—To maintain a card index, containing all references to the uses of grasses except the common agricultural uses, references to common names, extracts from notes of travelers, etc., for the purpose of assisting the Office of Foreign Seed and Plant Introduction in securing valuable grasses for introduction into the United States.

Procedure.—The work on this project consists in looking over literature and extracting the information needed. Part of this is current literature obtained from periodicals and is placed in catalogue form. Besides this, books of the past are worked on as time permits.

Grass Introduction Index—Continued.
Location.—Washington, D. C.
Date begun.—1910.
Results.—Index continued and many cards added.
Assignment.—A. S. Hitchcock.
Proposed expenditures, 1915–16.—$620.

Economic Grass Collections:
Object.—To obtain a collection of native and cultivated grasses of the world as material for study under various grass projects.
Procedure.—The grass herbarium is kept in proper order. The specimens have to be mounted and arranged so as to make the information available in classified form.
Cooperation.—National Herbarium.
Location.—Washington, D. C.
Date begun.—1868.
Results.—The grass herbarium contains about 120,000 sheets; revision of herbarium under way, specimens being arranged geographically, and keys to species of each genus made; duplicates arranged for distribution.
Assignment.—A. S. Hitchcock, Agnes Chase.
Proposed expenditures, 1915–16.—$2,595.

Miscellaneous Identification of Grasses:
Object.—To identify grasses sent in from various sources.
Procedure.—Specimens are identified as they come in and reports made on them in different forms, depending upon the character of the work.
Cooperation.—National Herbarium.
Location.—Washington, D. C.
Date begun.—1868.
Results.—Miscellaneous identifications during 1913 numbered 7,634 specimens.
Assignment.—A. S. Hitchcock, Agnes Chase.
Proposed expenditures, 1915–16.—$1,820.

Total, Botany of the Economic Grasses, $7,435.

SYSTEMATIC WORK IN ECONOMIC BOTANY.

Economic Collections:
Object.—To preserve and identify plants and plant products.
Procedure.—Specimens of plants are collected at the Arlington Farm and the several trial stations of the Bureau of Plant Industry. Material is also secured from other sources, including nurseries and seedmen's trial grounds. An herbarium is maintained in order to make the acquired information readily accessible and available.
Location.—Washington, D. C.
Date begun.—1907.
Results.—About 4,500 specimens have been added to the herbarium; a card index of desiderata is now in preparation, which will include cultivated plants not already in the collection.
Assignment.—P. L. Ricker.
Proposed expenditures, 1915–16.—$1,739.

Economic Monograph of the Heather and Blueberry Families, with Special Reference to Their Utilization in the United States:
Object.—Domestication of the blueberry and other plants of these families.
Procedure.—Blueberry hybrids are propagated from specially selected wild stocks by new methods in the greenhouse and field tests of the same made at a cooperative plantation in New Jersey. Some of the stock is distributed to private individuals throughout the country, in suitable locations, for trial.
Cooperation.—Blueberry growers.
Location.—Washington, D. C.; New England, New Jersey, and Indiana.
Date begun.—1908.
Results.—A new industry, blueberry culture, is in course of establishment; 20,000 hybrids from selected wild plants on hand; methods of commercial propagation worked out.
Probable date of completion.—1915.
Assignment.—Frederick V. Coville.
Proposed expenditures, 1915–16.—$1,640.

Systematic Botany of the Forage Plants Cultivated in America, Exclusive of the Grasses:

Object.—To publish taxonomic information on plant cultivation for forage in the United States.

Procedure.—Material is collected at the Arlington Farm and other experiment stations where various species of forage plants are in cultivation. Studies of the material are conducted in the field and in the herbarium.

Location.—Washington, D. C.

Date begun.—1910.

Results.—Many identifications have been made and assistance furnished to forage-plant breeders and experimenters.

Probable date of completion.—1918.

Assignment.—P. L. Ricker.

Proposed expenditures, 1915–16.—$1,071.

Ornamental Trees and Shrubs in the American Nursery Trade:

Object.—To devise an accurate classification for these plants.

Procedure.—Material of the class indicated growing in nurseries, parks, trial grounds, and private estates is collected, and this material, both in the living state and in the herbarium, is studied.

Cooperation.—Nurserymen.

Location.—Washington, D. C., and various parts of the United States.

Date begun.—1910.

Results.—Assistance has been rendered to nurserymen and horticulturists; hydrangea, berberis, and magnolia material studied, and over 200 specimens collected.

Assignment.—P. L. Ricker.

Proposed expenditures, 1915–16.—$1,464.

Monograph of the Grossulariaceæ, with Special Reference to the Species Useful in the United States:

Object.—To accurately classify American gooseberries and currants.

Procedure.—Living plants and herbarium material are collected and studied, with a view to securing suitable stocks for cultivation and for plant breeding.

Location.—Washington, D. C.

Date begun.—1907.

Results.—Work for the present is confined to the accumulation of data through receipt and identification of specimens.

Assignment.—Frederick V. Coville.

Proposed expenditures, 1915–16.—No allotment; work incidental to other projects.

Records of the Origin and Character of Varieties of Ornamental Plants Originating under Cultivation:

Object.—To secure uniformity of nomenclature and accuracy of descriptions in trade catalogues.

Procedure.—An index is kept of the cultivated plants offered in nurserymen's and seedsmen's catalogues.

Cooperation.—Horticulturists.

Location.—Washington, D. C.

Date begun.—1908.

Results.—An index of varieties is maintained, which is much used by various officers of the department.

Assignment.—P. L. Ricker.

Proposed expenditures, 1915–16.—$70.

Miscellaneous Identification:

Object.—To identify plant material submitted by agricultural and horticultural workers and from various other sources.

Cooperation.—Forest Service, various State stations, and correspondents.

Location.—Washington, D. C.

Date begun.—1868.

Results.—During 1914 there were 4,465 miscellaneous identifications made, a large proportion for the Forest Service.

Assignment.—P. L. Ricker, A. H. Moore, Ivar Tidestrom.

Proposed expenditures, 1915–16.—$2,536.

Total, Systematic Work in Economic Botany, $8,520.

Total, Investigations in Economic and Systematic Botany, $34,380.

[Research.]

DRY-LAND AGRICULTURE INVESTIGATIONS.

Supervision:

Object.—To supervise the maintenance of field stations and direct the agricultural work in dry-land areas of the Great Plains region, furnish facilities for investigational activities of other bureaus and offices of the department, and conduct the necessary routine office work in connection with this project group.

Cooperation.—Experiment stations of Montana, North Dakota, Nebraska, Colorado, Kansas, and New Mexico; Reclamation Service, Interior Department; Forest Service. (Independent stations not in cooperation with State experiment stations are maintained at Ardmore and Belle Fourche, S. Dak.; Amarillo, Big Spring, and Dalhart, Tex.; and Lawton and Woodward, Okla.)

Location.—Main headquarters, Washington, D. C.; field headquarters, Denver, Colo.

Date begun.—1905.

Assignment.—E. C. Chilcott, J. S. Cole, W. W. Burr.

Proposed expenditures, 1915–16.—$25,120.

Akron (Colo.) Field Station:

Object.—To determine the best methods of soil cultivation and crop rotations for the conservation of moisture and the maintenance of humus in the soil of the Great Plains area.

Procedure.—Two assistants in dry-land agriculture (one of whom is the superintendent) are detailed at this station during the growing season. The superintendent has full charge of, and is held responsible for, all the details of the cooperative work between this office and the various cooperating offices of the Bureau of Plant Industry. other bureaus, and the State experiment stations. He attends personally, with the aid of his assistant, to taking soil samples, making moisture determinations, taking meteorological observations, etc.; he supervises and takes notes, keeps records of the preparation, seeding, tillage, and harvesting dates, thrashing, weighing, and measuring of all crops grown on the cooperative plats. He is expected to provide facilities, such as land, tools, common labor, and office and laboratory space, for the cooperating offices of the bureau. During the winter months the assistants spend their time in the Washington office preparing the notes of the season's work for the permanent records or for publication. Complete records of all the cooperative work are kept both at the station and at the Washington office, where they are open to the inspection of the public at all times.

Cooporation.—Forest Service; Citizens' Association of Akron, Colo.; Colorado Experiment Station; and the county commissioners of Washington County, Colo.; also other offices in the Bureau of Plant Industry.

Location.—About 4 miles from Akron, Colo.

Date begun.—1907.

Results.—The results obtained through the experimental work being carried on at this station have been published in Department Bulletins 214, 218, 219, 222, 253, and 268.

Assignment.—O. J. Grace, A. E. Seamans.

Proposed expenditures, 1915–16.—$8,000.

Amarillo (Tex.) Field Station:

Object.—Same as preceding project.

Procedure.—Much the same as in preceding project.

Cooperation.—Chamber of Commerce, Amarillo, Tex.; other offices in the Bureau of Plant Industry.

Location.—About 1½ miles from Amarillo, Tex.

Date begun.—1906.

Results.—Published in Department Bulletins 214. 218. 219, 222. 242, and 268.

Assignment.—L. N. Jensen.

Proposed expenditures, 1915–16.—$2.300.

Archer (Wyo.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—Wyoming State Dry-Farming Commission; other offices of the Bureau of Plant Industry.

Location.—About 1 mile from Archer, Wyo.

Date begun.—1913.

Results.—Too early to formulate results. Cropping operations were started in the spring of 1913.

Assignment.—L. D. Willey.

Proposed expenditures, 1915–16.—$2.300.

Ardmore (S. Dak.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—Private individuals; other offices of the bureau.

Location.—About 2 miles from Ardmore, S. Dak.

Date begun.—1911.

Result.—Published in Department Bulletins 214, 218, 219, 222, and 268

Assignment.—F. L. Kelso.

Proposed expenditures, 1915–16.—$10.000.

Belle Fourche (S. Dak.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—Reclamation Service, Interior Department; Forest Service; other offices of the bureau.

Location.—Two miles from Newell, S. Dak.

Date begun.—1907.

Results.—Published as in preceding project.

Assignment.—O. R. Mathews.

Proposed expenditures, 1915–16.—$2.800.

Big Spring (Tex.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—Private individuals; other offices of the bureau.

Location.—One mile from Big Spring, Tex.

Date begun.—1914.

Results.—Cropping operations were started in the summer of 1914.

Assignment.—J. E. Mundell.

Proposed expenditures, 1915–16.—$15,000.

Colby (Kans.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—Kansas Experiment Station; other offices of the bureau

Location.—One mile from Colby, Kans.

Date begun.—1914.

Results.—Too early to formulate results. Cropping operations were started in the summer of 1914.

Assignment.—J. B. Kuska.

Proposed expenditures, 1915–16.—$2,300.

Dalhart (Tex.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—Dalhart Fair Association, Dalhart, Tex.; Forest Service; other offices of the bureau.

Location.—Three miles from Dalhart, Tex.

Date begun.—1907.

Results.—Published as shown under Amarillo Field Station.

Assignment.—W. D. Griggs.

Proposed expenditures, 1915-16.—$8,000.

Dickinson (N. Dak.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—North Dakota Experiment Station; other offices of the bureau.

Dickinson (N. Dak.) Field Station—Continued.

Location.—One mile from Dickinson, N. Dak.

Date begun.—1906.

Results.—Data obtained through the experimental work at this station have been published in Department Bulletins as shown under Ardmore Field Station and also in one bulletin of the North Dakota Experiment Station.

Assignment.—J. C. Thysell.

Proposed expenditures, 1915-16.—$2,300.

Edgeley (N. Dak.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—North Dakota Experiment Station; Forest Service; other offices of the bureau.

Location.—One mile from Edgeley, N. Dak.

Date begun.—1905.

Results.—Data on the experimental work carried on at this station have been published as shown under preceding project.

Assignment.—R. S. Towle.

Proposed expenditures, 1915-16.—$2,200.

Garden City (Kans.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—Kansas Experiment Station; other offices of the bureau.

Location.—Four miles from Garden City, Kans.

Date begun.—1906.

Results.—Published as shown under Amarillo Field Station.

Assignment.—C. B. Brown.

Proposed expenditures, 1915-16.—$2,800.

Hays (Kans.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—Kansas Experiment Station.

Location.—One-half mile from Hays, Kans.

Date begun.—1906.

Results.—Published as in preceding project.

Assignment.—A. L. Hallsted.

Proposed expenditures, 1915-16.—$2,300.

Hettinger (N. Dak.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—North Dakota Experiment Station; other offices of the bureau.

Location.—One-half mile from Hettinger, N. Dak.

Date begun.—1910.

Results.—Data published as shown under Dickinson Field Station.

Assignment.—A. J. Ogaard.

Proposed expenditures, 1915-16.—$2,300.

Huntley (Mont.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Location.—One-half mile from Huntley, Mont.

Date begun.—1909.

Results.—Published as shown under Amarillo Field Station.

Assignment.—G. W. Morgan.

Proposed expenditures, 1915-16.—$2,500.

Judith Basin (Mont.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—Montana Experiment Station; other offices of the bureau.

Location.—One mile from Judith Basin, Mont.

Date begun.—1907.

Results.—Published as in preceding project.

Assignment.—J. M. Stephens.

Proposed expenditures, 1915-16.—$2,500.

Lawton (Okla.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—Office of Indian Affairs, Interior Department; other offices of the bureau.

Location.—One mile from Lawton, Okla.

Date begun.—1915.

Results.—Cropping operations were started in March, 1915.

Assignment.—W. M. Osborn.

Proposed expenditures, 1915–16.—$14,700.

Mandan (N. Dak.) Field Station:

Object.—To assemble, test, develop, propagate, and distribute trees, shrubs, and other plants adapted to the climate and soil of the semiarid lands of the United States, and to demonstrate the value of these plants.

Procedure.—Same as preceding project.

Cooperation.—North Dakota Experiment Station; Forest Service; other offices of the bureau.

Location.—About 1 mile from Mandan, N. Dak.

Date begun.—1913.

Results.—Extensive experiments have been undertaken in connection with staple crops, forage crops, horticultural plantings, ornamental trees, climatic and meteorological studies, etc., but the work has not been carried on over a sufficient length of time to draw conclusions or formulate results.

Assignment.—W. A. Peterson, J. T. Sarvis, M. Pfaender.

Proposed expenditures, 1915–16.—$33,500.

North Platte (Nebr.) Field Station:

Object.—To determine the best methods of soil cultivation and crop rotations for the conservation of moisture and the maintenance of humus in the soil of the Great Plains area.

Procedure.—Same as preceding project.

Cooperation.—Nebraska Experiment Station.

Location.—Two miles from North Platte, Nebr.

Date begun.—1906.

Results.—Published as shown under Ardmore Field Station.

Assignment.—L. L. Zook.

Proposed expenditures, 1915–16.—$2,300.

Scottsbluff (Nebr.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—Nebraska Experiment Station; Reclamation Service; Forest Service; other offices of the bureau.

Location.—Six miles from Scottsbluff, Nebr.

Date begun.—1909.

Results.—Published as in preceding project.

Assignment.—J. H. Jacobson.

Proposed expenditures, 1915–16.—$2,500.

Tucumcari (N. Mex.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—Agricultural College of New Mexico; other offices of the bureau.

Location.—Two miles from Tucumcari, N. Mex.

Date begun.—1911.

Results.—Similar to those published as shown under Amarillo Field Station.

Assignment.—H. C. Smith.

Proposed expenditures, 1915–16.—$8,000.

Williston (N. Dak.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—North Dakota Experiment Station; other offices of the bureau.

Location.—One-half mile from Williston, N. Dak.

Date begun.—1908.

Williston (N. Dak.) Field Station—Continued.

Results.—Data published as shown under Dickinson Field Station.

Assignment.—C. H. Ruzicka.

Proposed expenditures, 1915–16.—$2,200.

Woodward (Okla.) Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—Other offices of the bureau.

Location.—Two miles from Woodward, Okla.

Date begun.—1914.

Results.—Too early to formulate results. Cropping operations were started in the season of 1914.

Assignment.—E. F. Chilcott.

Proposed expenditures, 1915–16.—$11,200.

Total, Dry-Land Agriculture Investigations, $167,120.

[Research.]

WESTERN IRRIGATION AGRICULTURE INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—To maintain field stations and supervise agricultural work on irrigated and other lands in the arid and semiarid regions of the West and to conduct routine office business in connection therewith.

Procedure.—Seven field stations are operated in the arid and semiarid regions of the West for the purpose of investigating agricultural conditions, studying and devising methods of crop production, and providing the various cooperating offices of the bureau with facilities for carrying on their special lines of investigation in the field. Each station is under the immediate supervision of a farm superintendent, who, with his assistants, attends to all the general and technical work, such as the taking of notes on the behavior of crops under different treatments, making moisture determinations, recording meteorological observations, the supervision of the cultural and harvesting operations connected with the experimental work, recording all notes on operations, crop yields, labor cost, etc. The superintendent also provides such facilities as land, teams, common labor, and office and laboratory supplies for the use of cooperating offices of the bureau.

Location.—Washington, D. C.

Date begun.—1905.

Assignment.—C. S. Scofield.

Proposed expenditures, 1915–16.—$20,135.

CROP PRODUCTION UNDER IRRIGATION.

Yuma (Ariz.) Field Station:

Object.—To develop agricultural methods under irrigation.

Procedure.—See preceding project.

Cooperation.—Office of Markets and Rural Organization; other offices of the Bureau of Plant Industry.

Location.—Near Bard, Cal.

Date begun.—1906.

Results.—Further work has been done in connection with securing maximum yields of alfalfa through the use of a green-manure crop on the sandy lands previous to seeding. Experiments with Durango cotton have given information of importance with reference to frequency of irrigation for this crop. Experimental plantings of a large number of varieties of orchard fruit have proceeded far enough to indicate something of the possibilities to be expected in this direction. Extension work in connection with the production of Durango cotton on the project has also been acomplished. A cotton growers' association was organized and the crop of 1914 marketed by this association.

Assignment.—R. E. Blair, C. E. Peterson.

Proposed expenditures, 1915–16.—$11,470.

Truckee-Carson (Nev.) Field Station:

Object.—To determine crop varieties and agricultural methods most suitable for successful farming on the Truckee-Carson Reclamation Project.

Procedure.—Same as preceding project.

Location.—Near Fallon, Nev.

Date begun.—1906.

Results.—Experiments in the reclamation of alkali lands have yielded additional important results. The drainage system installed on the farm has shown the possibility of keeping down the ground water table, and the use of small quantities of sulphuric acid on the heavier, impervious alkali lands has shown the possibility, through this method, of making this land easily permeable to water and consequently productive. The cooperative experimental and demonstrational work on private farms on the project has given very satisfactory results in stimulating interest among the farmers in increased crop production.

Assignment.—F. B. Headley, E. W. Curtis.

Proposed expenditures, 1915–16.—$10,500.

San Antonio (Tex.) Field Station:

Object.—To determine new and standard crops and agricultural methods adapted to successful farming in the vicinity of San Antonio, Tex.

Procedure.—Same as preceding project.

Location.—Near San Antonio, Tex.

Date begun.—1903.

Results.—The result of the investigations at this station on problems affecting the production of grain sorghums and the horticultural work has been summarized in publications on these subjects. The rotation work and other lines (with the exception of special attention to forage crops) have been continued. The results of the experiments in relation to grain sorghums have been particularly valuable to the farmers of the region, since they had not previously had a dependable grain crop. The extension work in connection with the production of Sudan grass has also been a feature of this station's activities.

Assignment.—S. H. Hastings, C. R. Letteer.

Proposed expenditures, 1915–16.—$9,426.

Belle Fourche (S. Dak.) Field Station:

Object.—To determine crop varieties and agricultural methods most suitable to successful agriculture on irrigated lands of the region.

Procedure.—Same as preceding project. It is proposed to extend the experiments in connection with pasture grasses and the production of forage crops for the use of live stock

Cooperation.—Forest Service.

Location.—Near Newell, S. Dak.

Date begun.—1907.

Results.—The irrigated rotation work at Belle Fourche has given results of much importance to the farmers of the region in indicating methods of farming by which larger yields of grain crops can be secured through rotation with alfalfa. The hog-pasturing work on alfalfa has also stimulated interest in the swine industry, which has been greatly increased on the project. The dairy industry is also progressing rapidly, and the results obtained from experiments with pasture grasses are being utilized in this connection. One of the most significant features of the past season's work has been the success attending experiments in the production of alfalfa seed. There is an active demand for alfalfa seed produced in the cold, dry region in which the Belle Fourche project is located, and the work of the station has indicated that this industry has great possibilities in that region.

Assignment.—Beyer Aune, John B. Wentz.

Proposed expenditures, 1915–16.—$9,832.

Huntley (Mont.) Field Station:

Object.—To determine crop varieties and agricultural methods most suitable to successful farming on the Huntley Reclamation Project.

Procedure.—Same as preceding project. It is proposed to extend the experiments in connection with pasture grasses and the production of forage crops for the use of live stock.

Location.—Near Huntley, Mont.

Huntley (Mont.) Field Station—Continued.

Date begun.—1909.

Results.—The rotation work on the irrigated lands of this station has been under way for three years and already shows significant results in the increased crop production following alfalfa and also the increased returns from alfalfa through the practice of hogging pasture. The reclamation of the tract of alkali land is approaching successful conclusion. Experiments with pasture grasses as a basis for a successful dairy industry have also given promising results.

Assignment.—Dan Hansen, John W. Knorr.

Proposed expenditures, 1915-16.—$10,140.

Umatilla (Oreg.) Field Station:

Object.—To determine crops and agricultural methods best adapted to successful farming on the sandy soils of the Umatilla Reclamation Project.

Procedure.—As outlined under project "Supervision."

Cooperation.—Forest Service and Oregon Experiment Station.

Location.—Near Hermiston, Oreg.

Date begun.—1909.

Results.—The horticultural work with testing orchard fruits, small fruits, and truck crops has been continued, though an unseasonable frost in 1914 interfered with securing additional information as regards varieties during that season. Experiments with green-manure crops and fertilizer tests have been continued and show that the water-holding capacity of the soil may be materially increased through the use of such crops. Experiments in determining the frequency and amount of irrigation required for the most economical production of alfalfa were carried on. These experiments indicate that it is possible to use a much smaller quantity of water than is usual in general practice on the project.

Assignment.—R. W. Allen, H. K. Dean.

Proposed expenditures, 1915-16.—$3,000.

Scottsbluff (Nebr.) Field Station:

Object.—To determine crop varieties and agricultural methods most suitable to successful agriculture on the irrigated lands of the region.

Procedure.—Same as preceding project. It is proposed to extend the experiments in connection with pasture grasses and the production of forage crops for the use of live stock.

Cooperation.—Nebraska Experiment Station.

Location.—Near Mitchell, Nebr.

Date begun.—1909.

Results.—In addition to the rotation experiments and the hog-pasturing work on alfalfa, experiments of this station have been extended into a study of various methods of pasturing hogs and various supplemental grain rations to be used. The results of the first year's work further confirm the earlier conclusions that the swine industry is one of the most profitable in the region, and the farmers are extending the industry rapidly and utilizing the results from the investigations at the station. A number of variety tests of cereals and corn are nearing completion, giving definite results as to the varieties best suited to the locality. In cooperation with the Nebraska Experiment Station, a small herd of dairy cows has been established on the farm, and through it direct results have been secured from the experiments with pasture grasses.

Assignment.—Fritz Knorr, James A. Holden.

Proposed expenditures, 1915-16.—$7,877.

Total, Crop Production under Irrigation, $62,245.

SOUTHWESTERN COTTON CULTURE.

Introduction of Commercial Cotton Culture in the Southwest:

Object.—To introduce into commercial culture in the arid Southwest profitable strains of long-staple cottons bred and acclimatized to meet local conditions.

Procedure.—This work has been carried on by the committee on southwestern cotton culture through a field representative working in direct cooperation with growers and marketing organizations.

Introduction of Commercial Cotton Culture in the Southwest—Continued.

Cooperation.—Office of Markets and Rural Organization.

Location.—Southern Arizona and southern California.

Date begun.—1906.

Results.—During 1914 the area planted to Egyptian cotton in the Salt River Valley amounted to about 12,000 acres, with a crop of slightly more than 6,000 bales. The area devoted to Durango cotton in the Imperial Valley of California and in the Yuma Valley aggregated something over 8,000 acres. The production of these two types of cotton is now well established on a commercial basis, and satisfactory marketing arrangements have been inaugurated by the growers in the two regions through the organization of associations. During the past year market conditions in Europe were investigated in connection with the promotion of these two long-staple industries, and direct connections were established with foreign users of these types of cotton. The promotion work in connection with the establishment of these two industries is gradually drawing to a conclusion, and the expenditures devoted to this work will be reduced during the coming fiscal year. It will be necessary for the department to continue some of its work in cooperation with the growers' associations for several years longer. This work will have to do chiefly with the improvement of the varieties to be used by the farmers, and the supervision of the field roguing in order to secure ample supplies of carefully selected seed for planting.

Assignment.—Argyle McLachlan.

Proposed expenditures, 1915-16.—$1,000.

Total, Western Irrigation Agriculture Investigations, $83,380.

[Research.]

POMOLOGICAL INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—General administration and direction of scientific lines of research and necessary incidental clerical work.

Cooperation.—Other offices within the department.

Location.—Washington, D. C.

Date begun.—1886.

Assignment.—L. C. Corbett, H. P. Gould.

Proposed expenditures, 1915-16.—$18,567.

FRUIT HANDLING AND STORAGE INVESTIGATIONS.

Fruit Handling and Storage Investigations:

Object.—To determine the factors that govern the successful transportation and storage of fruits.

Procedure.—These investigations are conducted by the handling of fruit from regions and orchards selected for the special problem in view. The fruit is picked, packed, and shipped under the direction of the bureau representatives and inspected by a representative at destination. Precooling investigations are conducted in the same general manner, shipments being made of comparable lots of precooled and unprecooled fruit, the precooling being accomplished either in commercial plants or with special equipment provided by the bureau. In the storage work, the fruit is handed in accordance with the aim of the problem in view, and the behavior of the fruit is determined by frequent inspections in cold and common storage warehouses to which the fruit is forwarded. The regions and orchards are selected also in accordance with the problem in view, the fruit being picked, packed, and handled under supervision of bureau representatives.

Cooperation.—Office of Markets and Rural Organization, fruit growers' associations and exchanges, individual growers, independent shippers, railway companies, refrigerator-car lines, storage warehouses, and fruit receivers.

Location.—Field work in Florida, Louisiana, Texas, Arkansas, North Carolina, Virginia, Pennsylvania, Michigan, New York, Maine, Illinois, Indiana, California, Oregon,. Washington, Idaho, and Montana, with in-

Fruit Handling and Storage Investigations—Continued.

spections at New York, Boston, Philadelphia, Pittsburgh, Chicago, Washington, D. C., Portland, Oreg., and other fruit-market centers.

Date begun.—1901.

Results.—The factors underlying the successful handling of shipments of fruits have been determined, especially of oranges, lemons, grapes, and berries in California; oranges and grapefruit in Florida; strawberries in Louisiana and Arkansas; apples, pears, and berries in Oregon, Washington, Montana, and Idaho; peaches in Georgia and Texas; and apples in the Atlantic and Middle-Western States. Data published in B. P. I. Bulletins 40, 48, 108, and 123; Department Bulletins 35 and 63; also in Department Yearbook articles, Bureau of Plant Industry circulars and documents, and miscellaneous papers and addresses; other department publications in the course of preparation.

Assignment.—H. J. Ramsey, S. J. Dennis, C. W. Mann, E. L. Markell, William E. Mosher, H. S. Bird, E. D. Vosbury, William C. Quick, Cyrus L. Dyer, V. W. Ridley, J. F. Fernald.

Proposed expenditures, 1915–16.—$38,100.

VITICULTURAL INVESTIGATIONS.

Vinifera Grape Investigations:

Object.—To determine the relative adaptability of (*a*) resistant grape stocks, (*b*) direct producers, and (*c*) Vinifera grape varieties to soil types and climatic and other conditions; to determine the relative congeniality of grape varieties to different resistant stocks; to determine the adaptability to soil types and climatic and other conditions of Vinifera grape varieties in regions not infested with phylloxera; if necessary, to test and create resistant direct producers valuable for the several purposes and suited to the different conditions in this country; to determine the uses of grape varieties; to determine the best methods of propagating, grafting, planting, cultivating, pruning, and training grape varieties in different environments; and to discover, develop, and disseminate valuable grape varieties.

Procedure.—Studies are made of resistant stocks, direct producers, Vinifera and other Euvitis, now planted in commercial vineyards, under a wide range of soil, climatic, and other conditions and in this department's experiment vineyards. Studies are made of the relative value of grape varieties for the different uses, their relative adaptability, vigor of growth, and ability to endure and resist drought, alkali, etc., as well as phylloxera and the various vine diseases. Special investigations of various viticultural problems presenting themselves are pursued in the department's experiment vineyards.

Cooperation.—Vineyardists and vineyard companies in California.

Location.—Washington, D. C.; and cooperative experiment vineyards located at Brawley, Colfax, Chico, Elk Grove, Fresno, Geyserville, Guasti, Lodi, Oakville, Sonoma, and Stockton, Cal.

Date begun.—1903.

Results.—The duplication of varieties used for resistant stocks in the several experiment vineyards has clearly demonstrated the sorts which are most advantageous for stocks in each of the several soil types upon which the vineyards are planted. The grafting which has been done between these resistant stocks and the several commercial sorts which thrive in the regions clearly brings out the combinations of stocks and varieties best adapted for commercial planting in the various vineyard regions. The superior values and uses of a number of grape varieties not grown in commercial vineyards have been demonstrated. Various tests of the currant-producing and of the Almerian storage and shipping grape varieties have given encouraging results. A color-record system was worked out and detailed color descriptions of 408 grape varieties made. In cooperation with the California Viticultural Exhibit Association, an exhibit of illustrations and processed fruits of the leading commercial Vinifera varieties was installed and a department viticultural exhibit of 96 colored transparencies prepared. The Livermore experiment vineyard was discontinued, while a new experiment vineyard was established at Elk Grove, Cal. General progress has been made along other lines. Results to 1909 were published in B. P. I. Bulletin 172:

Vinifera Grape Investigations—Continued.

results since then to 1914 in Department Bulletin 209. Results are also shown to date in annual reports of the Chief of the Bureau of Plant Industry.

Assignment.—George C. Husmann, Fred L. Husmann.

Proposed expenditures, 1915–16.—$9,750.

Muscadine Grape Investigations:

Object.—To determine methods of propagating, grafting, planting, pruning, spraying, cultivating, fertilizing, and growing Muscadine grapes: to determine the range and adaptability of known varieties; to originate and develop better Muscadine varieties and hybrids of them and other species (*a*) with larger clusters and better adherence of berry to pedicle, (*b*) of higher sugar and lower acid content, and (*c*) with perfect self-fertile flowers, etc.; and to determine best methods of utilizing the fruit.

Procedure.—Field studies of vineyards and vines throughout the Muscadine regions are made. All promising varieties are assembled into a comprehensve collection for observation and testing to determine their relative values. Experiments in commercial and experiment vineyards are conducted to determine best methods of trellising, pruning, training, spraying, pollenizing, cultivating, fertilizing, and growing Muscadine grapes.

Cooperation.—North Carolina Department of Agriculture, and private individuals.

Location.—Washington, D. C.; Willard, N. C.; and commercial vineyards throughout Muscadine regions.

Date begun.—1905.

Results.—It has been demonstrated that the commercial Muscadine varieties are practically self-sterile, that insects are the chief agencies of cross-pollination, and that interplanting of male vines is necessary. The breeding work has developed many desirable types, including self-fertile forms and hybrids with Vinifera and American Euvitis species. It has been demonstrated that pruning is necessary for best fruiting results and that good results can be obtained by growing Muscadines upon a vertical trellis. General progress has been made along other lines. Results to 1911 are published in B. P. I. Bulletin 273; results to date are shown in annual reports of chief of bureau.

Assignment.—George C. Husmann, Charles Dearing.

Proposed expenditures, 1915–16.—$4,000.

American Euvitis Investigations:

Object.—To determine the relative adaptability of native American grapes and their hybrids to the soil and climatic conditions of the various grape-growing regions of the United States; to determine the value and uses of the several species and other varieties in these regions; to determine the best methods of propagating, grafting, pruning, training, spraying, fertilizing, cultivating, and growing them; to develop and disseminate new and improved varieties; and to assist in reestablishing grape culture on a sound and rational basis.

Procedure.—Field studies are made of the adaptability to soils, climates, and other conditions; studies of resistance to alkali, drought, moisture, heat, cold, diseases, insects, etc.; researches to determine the value and uses of American Euvitis, their hybrids, and other species in commercial and experimental vineyards. Particular attention is given to methods of pruning, training, spraying, fertilizing, and culture.

Cooperation.—Vineyardists and vineyard companies in California and New Jersey.

Location.—Washington, D. C.; Vineland, N. J.; and Chico, Colfax, Fresno, Geyserville, Guasti, Oakville, and Sonoma, Cal.

Date begun.—1908.

Results.—Descriptions and illustrations have been made of a number of American grape varieties, and their value for dessert purposes and for the manufacture of unfermented juice determined. Valuable results are being obtained from tests of different methods of pruning, training, and fertilizing. Publications of results have appeared in annual reports of the chief of the bureau; in the Department Yearbook for 1904, "Some Uses of the Grapevine and Its Fruit"; B. P. I. Bulletin 241; Farmers'

American Euvitis Investigations—Continued.

Bulletin 644, "Manufacture and Use of Unfermented Grape Juice"; Farmers' Bulletin 471, "Grape Propagation, Pruning, and Training." A bulletin on American Euvitis investigations is in course of preparation.

Assignment.—George C. Husmann, Fred L. Husmann, Charles Dearing, H. J. Bock.

Proposed expenditures, 1915–16.—$3,500.

Total, Viticultural Investigations, $17,250.

FRUIT-PRODUCTION INVESTIGATIONS.

Adaptability of Fruit Varieties to Environment:

Object.—To obtain information regarding the kinds and varieties of fruit best suited for growing in different sections or regions for particular purposes.

Procedure.—Orchards in representative localities are visited during the course of the investigations, especially at the time the varieties are approaching maturity or about the time they are harvested. The conditions under which they have grown, such as soil, elevation, slope, climate, etc., are determined as far as possible. The behavior of the varieties under the conditions which exist from year to year is noted. Investigations are continued in a given section or district for a period of years in order that the observations shall cover a wide range of climatic and other conditions. The correlation of these repeated observations makes it possible to arrive at accurate conclusions regarding the adaptability of different varieties to different conditions.

Cooperation.—Fruit growers generally throughout the country, and especially in districts where systematic investigations have been made.

Location.—Washington, D. C.; field work throughout the United States.

Date begun.—1886.

Results.—A large number of phenological records are now being prepared for publication. B. P. I. Bulletins 135, 194, and 275 have been issued, and others are in course of preparation. Information obtained has aided very substantially in handling correspondence.

Assignment.—H. P. Gould, William F. Fletcher, George M. Darrow.

Proposed expenditures, 1915–16.—$5,500.

Fruit-Culture Investigations:

Object.—To secure information regarding the methods used in growing fruits in different parts of the country. These studies are not designed to cover the same points taken into consideration in the Office of Farm Management, but are for the purpose of determining and correlating the important cultural practices of various regions.

Procedure.—The work involves systematic study of fruit-growing practices, including propagation, planting, tillage, irrigation, fertilization, cover crops, interplanted crops, pruning, and such other operations as may be practiced in growing fruits.

Cooperation.—Fruit growers in different parts of the country.

Location.—Washington, D. C., and all fruit-producing districts of the United States.

Date begun.—1914, as a separate project; work developed in connection with other projects for a number of years.

Results.—Much information has been accumulated in previous years, incident to the prosecution of other lines of work, concerning methods of fruit growing in different regions. This information has made possible the ready handling of a large volume of correspondence which reaches the department regarding the growing of fruit. Several bulletins have also been published. Since the organization of the work as a project Farmers' Bulletins 631, 632, 633, 643, and 664 have been issued. Others are in course of preparation.

Assignment.—H. P. Gould, George M. Darrow.

Proposed expenditures, 1915–16.—$7,600.

Cooperative Dry-Land Ranch Fruit-Garden Investigations:

Object.—To work out the best methods of culture for the growing of the different kinds of fruits under the semiarid conditions of the Great Plains area, and to determine varieties best suited to these conditions for furnishing a home fruit supply.

Cooperative Dry-Land Ranch Fruit-Garden Investigations—Continued.

Procedure.—Field studies are made of carefully selected varieties of orchard and small fruits.

Location.—Akron, Colo., and Amarillo, Tex.

Date begun.—Akron, 1908; Amarillo, 1911.

Results.—At Akron about 240 trees have been planted, representing apples, crab apples, pears, peaches, plums, and cherries; also small fruits, including currants, gooseberries, raspberries, blackberries, strawberries, and others. Some varieties of all of these have fruited, thus indicating in a measure their relative value, or have failed entirely, showing their lack of adaptability to these conditions. Peaches, raspberries, and blackberries are conspicuous in the latter group, while plums, cherries, currants, and gooseberries are among the most promising. At Amarillo about 185 trees have been planted, including apples, plums, and cherries. Several varieties of plums and cherries have fruited. The data obtained from the Akron garden are sufficient to warrant a preliminary report in the form of a bulletin.

Probable date of completion.—1925.

Assignment.—H. P. Gould, Oliver J. Grace, John F. Ross.

Proposed expenditures, 1915–16.—$75.

Nursery Investigations:

Object.—To determine the most efficient and economic methods of propagating fruits; to determine the congeniality between various fruits and those plants used for stocks for same, as well as the adaptability of different stocks to different climatic and soil conditions.

Procedure.—Stocks now commonly used, as well as plants of related species which are not at present extensively used as stocks, will be secured for the purpose of working different species and varieties upon them to determine, first, their congeniality; second, the adaptability of the stocks to different soil and climatic conditions; and, third, the relative value of different methods of budding, grafting, and handling of cuttings. It is proposed to conduct the work at the various breeding stations, including Arlington, Va., Troup, Tex., Mandan, N. Dak., Chico, Cal., and Storrs, Conn.

Cooperation.—Texas and Connecticut (Storrs) experiment stations, and nurserymen.

Location.—Points mentioned under "Procedure."

Date begun.—1915.

Assignment.—W. F. Wight, H. P. Gould, George M. Darrow.

Proposed expenditures, 1915–16.—$575.

Total, Fruit-Production Investigations, $13,750.

NUT-CULTURE INVESTIGATIONS.

Nut-Culture Investigations:

Object.—To determine the range of adaptability of different nuts, the relative value and merit of different varieties, their cultural requirements, and methods of propagation.

Procedure.—Nut growers, dealers, nurserymen, and private individuals.

Cooperation.—National Nut Growers' Association, Northern Nut Growers' Association, and nut growers and dealers throughout the United States.

Location.—Washington, D. C., Arlington, Va., and nut-growing sections throughout the United States.

Date begun.—About 1890.

Results.—Data published in various issues of the Department Yearbook and in B. P. I. Bulletins 251 and 254 and Circular 112; addresses published in the annual proceedings of the National Nut Growers' Association, the Northern Nut Growers' Association, and other organizations. Information accumulated has also made possible the ready handling of a wide range of correspondence received at the department concerning nut growing.

Assignment.—C. A. Reed.

Proposed expenditures, 1915–16.—$4,950.

FRUIT IMPROVEMENT THROUGH BREEDING, SELECTION, AND DOMESTICATION.

Mississippi Valley Hardy-Fruit Breeding:

Object.—To breed hardy fruits adapted to climatic and soil conditions in the upper Mississippi and Missouri Valleys.

Procedure.—The results of extensive breeding work conducted by Mr. C. G. Patten are being used as a basis of further breeding tests and investigations to determine the fundamental principles involved in the production of hardy fruits adapted to the rigorous conditions of the upper Mississippi and Missouri Valleys.

Cooperation.—Iowa Experiment Station and Iowa State Horticultural Society.

Location.—Ames, Iowa.

Date begun.—1909.

Results.—About 20 acres of closely planted trees of definite parentage are now under culture. A large number of seedlings, the result of crosses of 1914, are now developing. Crossing work for 1915 has largely been completed.

Assignment.—Charles G. Patten, C. L. Watrous, S. A. Beach, W. F. Wight.

Proposed expenditures, 1915–16.—$800.

Fruit Improvement Through Bud Selection:

Object.—To improve citrus fruits, especially oranges, lemons, and pomelos, by selection and breeding; to investigate methods for determining reliable and valuable parent trees and other plants from which to propagate uniform and improved strains of deciduous fruits.

Procedure.—Extensive orchard observations are made in bearing citrus and deciduous fruit areas of California, Michigan, and Connecticut, for the purpose of determining the annual behavior of individual orchard trees. The data thus secured are used as a basis for determining trees which are commercially profitable, as well as those which are unprofitable, and to determine the character and value of the fruits produced by the plants under observation. This is made the basis for eliminating or top-working those plants which are not profitable.

Cooperation.—Commercial citrus and deciduous fruit growers.

Location.—Riverside, Cal., and Connecticut.

Date begun.—1910.

Results.—Data of yield of individual citrus trees secured; parent citrus trees selected and a suitable number of nursery trees propagated from them; data accumulated for use in connection with further prosecution of deciduous-fruit improvement work; B. P. I. Circular 77 issued.

Assignment.—A. D. Shamel, Leo B. Scott, C. S. Pomeroy.

Proposed expenditures, 1915–16.—$13,000.

Rosaceous-Fruit Breeding Investigations:

Object.—To study the fundamental principles involved in the breeding of new and improved varieties of rosaceous fruits, and to produce varieties of improved intrinsic quality, hardiness, productiveness, and disease resistance in the different fruit-producing regions of the country.

Procedure.—Crosses and selections are being made between the most promising types of fruits in the several fruit-producing regions for the express purpose of securing, if possible, varieties capable of enduring or overcoming certain extreme conditions existing in these fruit regions, or for the purpose of producing fruits which shall ripen at a period to better meet the needs of the market's supply from these regions. Work is being conducted at Troup, Tex., Charles City, Iowa, Arlington, Va., and Storrs, Conn.

Cooperation.—Texas and Iowa experiment stations, Iowa State Horticultural Society, and private individuals.

Location.—Arlington, Va.; Texas; and Iowa.

Date begun.—1913.

Results.—A large number of varieties of peaches and plums in Texas and of apples, plums, and pears in Iowa have been pollinated.

Assignment.—W. F. Wight.

Proposed expenditures, 1915–16.—$3,950.

Total, Fruit Improvement through Breeding, Selection, and Domestication, $17,750.

INVESTIGATIONS IN SYSTEMATIC POMOLOGY.

Fruit-History Investigations:

Object.—To accumulate data relating to the history of varieties of fruit with special reference to old and little-known varieties and classes of fruits; to assemble information relating to the origin of varieties, as well as pertaining to the cultural range and extent of planting in the past.

Procedure.—This project is carried on through correspondence and discussion with interested parties and the accumulation of data by reference to printed volumes, periodicals, and other miscellaneous sources.

Cooperation.—Individual fruit growers throughout the United States. State libraries, and State and national societies.

Location.—Washington, D. C.

Date begun.—1913.

Results.—A mass of data has been assembled, systematized, indexed, and filed.

Assignment.—L. C. Corbett.

Proposed expenditures, 1915–16.—$5,075.

Fruit-Nomenclature Investigations:

Object.—To secure a simple, pure, and stable nomenclature of the cultivated American fruits.

Procedure.—Data are secured through correspondence with interested parties, by reference to current and standard literature,, and by verification of varieties in trial grounds at Arlington, Va., and elsewhere throughout the United States.

Cooperation.—American Pomological Society and various State horticultural and pomological societies.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—1901.

Results.—A number of publications have been issued and others are in course of preparation

Assignment.—E. R. Lake.

Proposed expenditures, 1915–16.—$4,140.

Fruit-Identification Investigations:

Object.—To secure information about varieties of fruits and to name them for interested parties throughout the United States; to prepare illustrations, models, and descriptions of varieties for use in identification work.

Cooperation.—State experiment stations, county agents, agricultural periodicals, and individual fruit growers throughout the United States.

Location.—Washington, D. C.

Date begun.—About 1890.

Results.—Approximately 7,700 identifications were made during the fiscal year 1915.

Assignment.—C. P. Close.

Proposed expenditures, 1915–16.—$9,400.

Total, Investigations in Systematic Pomology, $18,615.

FRUIT-UTILIZATION INVESTIGATIONS.

Fruit-Utilization Investigations:

Object.—To secure information relative to the best and most practical methods of using the lower grades of fruit and surplus stock which can not be marketed profitably in a fresh state.

Procedure.—The methods of desiccation, canning, and preserving fruits are being studied with the idea of modifying commercial practices in such a way as to adapt them to the needs of the individual fruit grower so situated as not to be able to take advantage of the markets offered by the commercial industry, in order to conserve a large and valuable product which is now largely lost because there are no simple and inexpensive methods of quickly converting it into a stable, marketable product.

Cooperation.—Bureau of Chemistry.

Location.—Washington, D. C.

Date begun.—About 1910.

Results.—Data have been accumulated which, prior to publication, are proving of value in answering inquiries from correspondents and incidentally in other ways. Farmers' Bulletins 213, 291, and 426 have been

Fruit-Utilization Investigations—Continued.

issued. Information regarding desiccation of berries other than black raspberries, as well as prunes, peaches, and figs, has been secured.

Assignment.—C. W. Mann, H. C. Gore.

Proposed expenditures, 1915–16.—$2,325.

Total, Pomological Investigations, $131,307.

[Research.]

HORTICULTURAL INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—General administration and direction of scientific lines of research and necessary incidental clerical work.

Cooperation.—Other offices within the department.

Location.—Washington, D. C.

Date begun.—1900.

Assignment.—L. C. Corbett, H. P. Gould.

Proposed expenditures, 1915–16.—$14,873.

VEGETABLE HANDLING AND STORAGE INVESTIGATIONS.

Vegetable Handling and Storage Investigations:

Object.—To determine the factors that govern the successful transportation and storage of vegetables.

Procedure.—These investigations are conducted by the handling of vegetables from regions and trucking sections selected for the special problem in view. The vegetables are harvested, packed, and shipped under the direction of bureau representatives, and inspected by a representative at destination. Precooling investigations are conducted in the same general manner, shipments being made of comparable lots of precooled and unprecooled vegetables, the precooling being accomplished either in commercial plants or with special equipment provided by the bureau. In the storage work the vegetables are handled in accordance with the aim of the problem in view, and the behavior of the vegetables is determined by frequent inspections in cold and common storage warehouses to which the vegetables are forwarded. The trucking regions are selected also in accordance with the problem in view. the vegetables being harvested, packed, and handled under the supervision of bureau representatives.

Cooperation.—Office of Markets and Rural Organization. vegetable growers' associations and exchanges, individual growers, independent shippers, railway companies, refrigerator-car lines. storage warehouses, and vegetable receivers.

Location.—Field work in Georgia, Florida. Indiana, New York, New Jersey, Pennsylvania. and Maine, with inspections at New York, Boston, Chicago, and other vegetable-marketing centers.

Date begun.—About 1912.

Results.—The factors underlying the successful handling and shipment of vegetables have been determined, especially of celery in Florida and New York, lettuce in Florida, tomatoes in Florida and Mississippi, and melons in Georgia and Indiana. Data published in Farmers' Bulletins 282 and 548.

Assignment.—H. J. Ramsey, H. C. Thompson, William Stuart, D. N. Shoemaker, E. L. Markell.

Proposed expenditures, 1915–16.—$3,400.

TRUCK-CROP PRODUCTION INVESTIGATIONS.

Truck-Crop Culture Investigations:

Object.—To determine the truck-crop and market-gardening possibilities of various sections of the United States, and to ascertain the factors limiting crop production or responsible for crop deterioration; to determine the best methods of cultivating, propagating, fertilizing, harvesting, packing, and storing vegetable crops; to determine for watermelons and muskmelons the cause of crop deterioration and loss in the field as well

Truck-Crop Culture Investigations—Continued.

as in handling and marketing; for sweet potatoes, the best cultural practices, including propagation of plants, planting, fertilization, harvesting, and storing, as well as varietal adaptability; for onions, the best growing and storage methods, as well as the possibility of producing Denia onions and growing Denia onion seed; for asparagus, the fertilizers and method of cultivation for best results; for spinach, the reason for the losses now experienced in cultivating spinach in those sections where the industry has long been carried on; for celery, the methods of handling to overcome losses in the field and in storage.

Procedure.—Surveys of truck-growing and market-gardening districts in which the above-enumerated crops demand attention because of deterioration or losses are made to determine the factor or factors in the cultural or handling operations which are responsible for the loss or deterioration. As soon as these factors are determined, tests are planned and inaugurated for the purpose of developing practical means of overcoming these difficulties or losses. Each crop district is carefully surveyed, the limiting factors noted so far as they can be determined, and plans inaugurated to test the effectiveness of known methods of overcoming such handicaps.

Cooperation.—State experiment stations of Delaware, North Carolina, and South Carolina; the Virginia Truck Experiment Station at Norfolk, Va.; practical growers, shippers, and storage warehousemen.

Location.—Indiana, Illinois, Maryland, New Jersey, Delaware, Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi, Louisiana, Arkansas, Texas, New York, Ohio, New Mexico, Arizona, California, Michigan, Florida, and Washington, D. C.

Date begun.—1900.

Results.—Sweet potato investigations: Satisfactory methods of storage have been worked out and demonstrated in the South. The varieties have been classified and grouped; data in Farmers' Bulletins 324 and 548 and special circular from the Office of the Secretary.

Onion investigations: Denia onions produced in this country are equal to the imported product. Home-grown seed has given results which indicate that it is as satisfactory as imported seed; data published in Farmers' Bulletins 354 and 434.

Asparagus investigations: Survey work completed; fertilizer trials being continued; records kept of fertilizers applied and cut crop returned from the different plats.

Spinach investigations: The use of inorganic fertilizers alone is not sufficient to remedy the physical conditions which contribute to the spinach trouble.

Celery investigations: Data in Farmers' Bulletin 282 and additional data to be used in a new bulletin; development of satisfactory packages for storage of celery and fundamental data on storage problems secured.

Muskmelon and watermelon investigations: Valuable results indicated in connection with the influence of climate; relative value of different strains for long-distance transportation determined.

Assignment.—W. W. Tracy, sr., H. C. Thompson, D. N. Shoemaker, H. M. Conolly, Fred E. Miller.

Proposed expenditures, 1915–16.—$7,000.

Adaptability of Vegetables to Environment:

Object.—To determine the varieties of vegetables which are best suited for growing under different conditions for particular purposes.

Procedure.—Field studies are made of different varieties in different sections of the country, and their behavior from year to year as observed under different soil and climatic conditions is noted.

Cooperation.—Vegetable growers in different parts of the country.

Location.—Washington, D. C., Arlington, Va., and other points as may be arranged.

Date begun.—1905.

Results.—Considerable information has been accumulated and has aided materially in the handling of correspondence.

Assignment.—W. W. Tracy, sr., D. N. Shoemaker, H. C. Thompson.

Proposed expenditures, 1915–16.—$2,000.

Truck-Crop Fertilizer Investigations:

Object.—To determine the injurious effects, if any, of continuous heavy applications of inorganic soils to lands perpetually cropped in hoe crops; to determine the rotations which can be used in truck-crop practice which will maintain the productive capacity of the soil.

Procedure.—An elaborate experiment has been under way since 1908. In this work nearly all kinds of fertilizers have been used in varying amounts and combinations, with several kinds of vegetables in rotation. In addition to commercial fertilizers, manure, crimson clover, and lime are used, each alone and in combination with fertilizers. Accurate records are kept of the yields of all plats.

Cooperation.—Virginia Truck Experiment Station.

Location.—Norfolk, Va.

Date begun.—About 1908.

Results.—The experiments have shown the need of adding humus to these soils and that phosphorus is the limiting fertilizing element. Results published in Virginia Truck Experiment Station Bulletin 9, "Fertilizer Experiments with Kale."

Assignment.—H. C. Thompson, T. C. Johnson.

Proposed expenditures, 1915–16.—$750.

Peanut Investigations:

Object.—To improve commercial varieties of peanuts; to determine the best cultural methods, including the use of fertilizers, crop rotations, and methods of harvesting, thrashing, etc.; to extend the use of the peanut as human food; and to demonstrate the value of the peanut as a forage crop, especially in connection with pork production in the Southern States.

Procedure.—Field studies are made to secure data on the methods of cultivation, fertilization, rotation, harvesting, and thrashing. In the work of improving varieties selections are made of high-yielding hills, and these are planted in experimental breeding plats and subsequent selections made.

Cooperation.—Virginia and South Carolina experiment stations, farmers, oil mills, cleaners, handlers, and peanut-butter manufacturers.

Location.—Virginia, North Carolina, South Carolina, Alabama, Mississippi, Louisiana, Texas, and Oklahoma.

Date begun.—1905.

Results.—Data in Farmers' Bulletin 282, B. P. I. Circular 98, special circular of Office of Secretary, and in circular letter. The growing of peanuts has been greatly extended throughout the South, especially as a food for live stock. Interest has been created in the manufacture of peanut oil in this country.

Assignment.—H. C. Thompson, F. E. Miller.

Proposed expenditures, 1915–16.—$2,250.

Investigations of the Adaptation of Truck Crops to Organic Soils (Mucks and Peats):

Object.—To determine truck crops adapted to organic soils; to study methods of treatment of different types of soils and their use in growing greenhouse crops.

Procedure.—Representative tracts of organic soils are selected for experimental work, both in the field and under glass. In the field work fertilizer and cultural investigations are carried on with the important organic-soil vegetables. In the greenhouse various mixtures of organic soils, sand, and clay are used in growing the common greenhouse vegetables and flowers. In addition to the experimental features of this work, field studies are made and data secured on the crops grown and methods of culture practiced in the various sections of the country.

Cooperation.—American Peat Society, Bureau of Mines, Indiana Experiment Station, and practical truck growers.

Location.—Washington, D. C.; New Jersey, Indiana, Ohio, and Michigan.

Date begun.—1912.

Results.—Data have been secured on fertilizers for truck crops in the field. Greenhouse experiments show the value of organic soils in forcing greenhouse crops.

Assignment.—H. C. Thompson, H. M. Conolly, F. E. Miller.

Proposed expenditures, 1915–16.—$1,000.

Investigation of the Commercial Production of Vegetable and Flower Seeds:

Object.—To determine the most economical and successful methods of growing vegetable and flower seeds.

Procedure.—Field tests are conducted and the methods commonly used in different parts of the country by commercial seed growers are studied.

Cooperation.—Seed growers throughout the United States.

Location.—Washington, D. C., Arlington, Va., and the farms of seed growers with whom arrangements may be made from time to time.

Date begun.—1907.

Assignment.—W. W. Tracy, sr., D. N. Shoemaker.

Proposed expenditures, 1915–16.—$1,000.

Total, Truck-Crop Production Investigations, $14,000.

TRUCK-CROP IMPROVEMENT THROUGH BREEDING, SELECTION, AND DOMESTICATION.

Standardization of Commercial Varieties of Vegetables through Selection:

Object.—To standarize the different varieties of vegetables with a view to securing uniformity in size, season, productiveness, etc.

Procedure.—Seeds of the best strains of different varieties are planted, selections which conform most closely to the desired type made, seeds grown from these, and the selection continued until the desired uniformity of type is obtained.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—1903.

Results.—Certain varieties of cauliflower and cabbage have been developed to a very high degree of uniformity, and similar progress has been made with various other vegetables.

Assignment.—W. W. Tracy, sr., D. N. Shoemaker.

Proposed expenditures, 1915–16.—$1,645.

Improvement of Vegetables through Hybridization and Domestication:

Object.—To develop better strains and varieties of vegetables through the usual processes of crossing and hybridization.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—1915.

Assignment.—D. N. Shoemaker.

Proposed expenditures, 1915–16.—$1,645.

Total, Truck-Crop Improvement through Breeding, Selection, and Domestication, $3,290.

IRISH-POTATO INVESTIGATIONS.

Irish-Potato Investigations:

Object.—To determine the influence of soil and climate on the quality and productiveness of potatoes; determine conditions necessary for the production of tubers of special merit for baking and boiling purposes; select and develop strains of potatoes particularly suitable to special soil and climatic conditions and for the purpose of increasing the yield per acre by eliminating unproductive hills; determine the best source of seed potatoes; study the influence of storage conditions on vitality, rate of germination, and crop yields; study cultural practices to improve potato culture; produce new varieties of better quality, greater disease resistance, and greater productiveness; import foreign wild and cultivated sorts to improve cultivated varieties; conduct nutrition investigations to determine the food requirements of the potato plant; conduct investigations to determine conditions which influence tuber development; maintain a variety collection to improve existing strains by hill selections and tuber-unit methods; determine the relative value of different methods of treating, handling, and cutting seed potatoes; and study the nomenclature and varietal relationships of our present commercial varieties of potatoes.

Procedure.—Field experiments are conducted at stations maintained at Presque Isle, Me., Arlington and Norfolk, Va., Greeley, Colo, Jerome, Idaho, and Middle River, Cal. In the irrigation investigations at Greeley, Colo., and Jerome, Idaho, the rate and date of application of water to the growing crop will be determined, for the purpose of ascertaining its effect upon the resultant health and productiveness of the plants. A

Irish-Potato Investigations—Continued.

test at Greeley, Colo., has in view the determination of the relative value of certified seed potatoes. A study of the relative vigor and productiveness of plants produced from mature and immature seed is under way; also experiments with potatoes to determine their relative value for culinary purposes.

Cooperation.—Maine Experiment Station, Virginia Truck Experiment Station, Colorado Experiment Station, Greeley (Colo.) Commercial Club, and the Delta Association at Stockton, Cal.; also nominal cooperative relationship with the Idaho Experiment Station.

Location.—Arlington and Norfolk, Va.; Presque Isle, Me.; Jerome, Idaho; Middle River, Cal.; Highlands, N. C.; Greeley, Colo.; Mitchell, Nebr.; and points in Minnesota.

Date begun.—1902.

Results.—About 70,000 seedlings have been grown to date, of which approximately 6,400 have been discarded as unfit for further test and approximately 6,000 are now under observation. Data in Farmers' Bulletins 407 and 533; B. P. I. Circular 113; Department Bulletin 176, "Group Classification and Varietal Descriptions of Some American Potatoes"; and Department Bulletin 195, "Potato Breeding and Selection."

Assignment.—William Stuart, W. V. Shear, C. F. Clark, G. W. Dewey, P. M. Lombard.

Proposed expenditures, 1915–16.—$23,620.

VEGETABLE HISTORY AND NOMENCLATURE INVESTIGATIONS.

Vegetable History and Nomenclature Investigations:

Object.—To accumulate data relating to the history of varieties of vegetables, with special reference to old and little-known varieties; to assemble information relating to the origin of varieties; and to secure a simple and stable nomenclature for the cultivated vegetables.

Procedure.—This work is conducted through correspondence and discussion with interested parties, the accumulation of data by reference to current and standard literature, and by verification of varieties on trial grounds at Arlington, Va., and elsewhere throughout the United States.

Cooperation.—National Vegetable Growers' Association, horticultural societies throughout the United States, and State libraries.

Location.—Washington, D. C., and various points throughout the United States.

Date begun.—1903.

Results.—Data have been collected and placed on file in anticipation of a systematic prosecution of the history work. Publications: B. P. I. Bulletin 69, "American Varieties of Lettuce," and B. P. I. Bulletin 109, "American Varieties of Garden Beans."

Assignment.—W. W. Tracy, sr., D. N. Shoemaker.

Proposed expenditures, 1915–16.—$200.

VEGETABLE-UTILIZATION INVESTIGATIONS.

Vegetable-Utilization Investigations:

Object.—To secure information relative to the best and most practical methods of using the lower grades of vegetables and surplus stock which can not be marketed profitably in a fresh state.

Procedure.—The methods of desiccating, canning, and preserving vegetables are being studied with the idea of modifying commercial practices in such a way as to adapt them to the needs of the individual vegetable grower so situated as not to be able to take advantage of the markets offered by the commercial industry, in order to conserve a large and valuable product which is now largely lost because there are no simple and inexpensive methods of quickly converting it into a stable marketable product.

Cooperation.—Bureau of Chemistry.

Location.—Washington, D. C.

Date begun.—About 1905.

Results.—Many data accumulated in regard to the canning of tomatoes, preparation of pickles, and along various other lines.

Assignment.—C. W. Mann, H. C. Gore.

Proposed expenditures, 1915–16.—$1,000.

LANDSCAPE-GARDENING AND FLORICULTURE INVESTIGATIONS.

Landscape-Gardening Investigations:

Object.—To study the adaptability and uses of trees, shrubs, and other plants for ornamental planting about schools and farmsteads, on streets and roadsides, and in parks and other places; to prepare planting plans; to study the regional adaptability of varieties and their relation to environment; and to study the adaptability of native wild species and such other features of landscape gardening as may from time to time call for attention.

Procedure.—The study of adaptability is conducted by observing the plants used for various purposes and the effects obtained. Planting plans are prepared for Government grounds when requested, also for a limited number of schools in each State, provided they are teaching agriculture, and occasionally for a farmstead where there is assurance of its being carried out and the value for purposes of demonstration seems to warrant. The regional adaptabilities of varieties are studied from published lists of plants thriving in specific localities; by the recorded observation of voluntary cooperative observers; by experimental work, such as the testing of plants at various selected stations; and in cooperation with national forest rangers.

Cooperation.—Voluntary individual observers, experiment station horticulturists, park superintendents, and Forest Service nurseries and experiment stations.

Location.—Washington, D. C.; Arlington and Norfolk, Va.; Augusta and Atlanta, Ga.; Highlands, N. C.; Ithaca, N. Y.; Harrisburg, Pa.; Camden and Cleveland, Ohio; Lake Forest, Ill.

Date begun.—1901.

Results.—From a large amount of data obtained generalization may now reasonably be made concerning street and roadside trees, hedges, and seaside plants for certain restricted areas.

Assignment.—F. L. Mulford.

Proposed expenditures, 1915–16.—$4,180.

Floriculture Investigations:

Object.—To determine the factors controlling the propagation, growing, handling, and disposal of tender plants, cut flowers, and other plants suitable for florists' use, whether under glass or outdoors; also to determine the principles underlying the production of new varieties for this purpose, the improvement of varieties, and the domestication and introduction of wild plants of value for floricultural purposes.

Procedure.—Studies are made by visiting florists' establishments, and dealers, as well as by growing the plants. Crosses are made of promising species and varieties, the seedlings are grown, and selections made from them. Records are made of new introductions, their history, and character.

Cooperation.—Florists, floricultural societies, and individuals.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—1904.

Results.—New varieties of dahlias and chrysanthemums have been produced and progress with similar work on carnations has been made.

Assignment.—F. L. Mulford, G. W. Oliver, E. M. Byrnes.

Proposed expenditures, 1915–16.—$1,650.

Bulb-Growing Investigations:

Object.—To study the possibilities of growing bulbs of various kinds in the United States, including their propagation, handling, curing, and testing, and to render assistance in developing a bulb-growing industry.

Procedure.—Bulbs of various kinds are grown either on a commercial scale or in an experimental way and tested as to their value as compared with bulbs grown at other points.

Location.—Washington, D. C., and Bellingham, Wash.

Date begun.—1902.

Results.—Bermuda lilies have been grown successfully from seed. Bulbs of narcissi, tulips, and hyacinths have been grown at Bellingham, Wash., that compare favorably with bulbs grown elsewhere. Department Bulletin 28, "Experiments in Bulb Growing at the United States Bulb Garden

Bulb-Growing Investigations—Continued.
at Bellingham," and B. P. I. Bulletin 39, "The Propagation of the Easter Lily from Seed," have been issued.
Assignment.—P. H. Dorsett, Peter Bisset, F. L. Mulford.
Proposed expenditures, 1915–16.—$400.

Nursery Investigations:
Object.—To determine the most efficient and economic methods of propagating ornamental plants; to determine the congeniality between various ornamental plants and those plants used for stocks for same, as well as the adaptability of different stocks to different climatic and soil conditions.
Procedure.—Cuttings from blind and flowering wood are used to determine the relative value of such stocks for propagating roses. The value of cuttings from floriferous plants as compared with the ordinary greenhouse run of stock is being tested. The requirements of seeds of different kinds, as well as the adaptation of different ornamental plants to propagation by stratification, layers, cuttings, budding, and grafting are considered in connection with the different species investigated.
Cooperation.—Nurserymen and private individuals throughout the United States.
Location.—Washington, D. C., Arlington, Va., and nurseries with which cooperation may be arranged from time to time.
Date begun.—1915.
Assignment.—F. L. Mulford.
Proposed expenditures, 1915–16.—$300.

Greenhouse Investigations:
Object.—To study the methods of greenhouse, hotbed, and cold-frame construction best adapted for various purposes, including methods of heating, ventilating, glazing, bench construction, and other details; to study soil and moisture conditions and the relation of all factors to the successful growth of ornamental and florists' plants, vegetables, and fruits.
Procedure.—The subject is studied through investigations of the methods and practice of commercial establishments and through definite experiments at Arlington Farm on special phases of the problems as they can be taken up.
Cooperation.—Office of Farm Management and individual growers.
Location.—Field work in most of the States east of the Rocky Mountains.
Date begun.—1914.
Results.—About 3,000 greenhouse plants have been studied and many records obtained. Manuscripts for two bulletins are under way.
Assignment.—L. C. Corbett.
Proposed expenditures, 1915–16.—$1,320.

Total, Landscape-Gardening and Floriculture Investigations, $7,850.

Total, Horticultural Investigations, $68,233.

[Research.]

ARLINGTON FARM.

Arlington Farm:
Object.—To maintain a field laboratory for the various bureaus and offices of the Department of Agriculture.
Cooperation.—Various bureaus and offices of the department.
Location.—Rosslyn, Va.
Date begun.—1900.
Results.—As in the past, the farm has endeavored to render all possible assistance by providing the land, labor, equipment, and other necessary facilities, such as shops, greenhouses, etc., in connection with the research work of many offices of the Bureau of Plant Industry and other bureaus of the department conducting investigations there. The soil is being gradually improved, drainage systems extended, and ornamental plantings increased. Several new areas have been cleared and brought under cultivation. In order to provide the necessary greenhouse and laboratory facilities to meet increased demands, a small greenhouse and

Arlington Farm—Continued.

several semifireproof concrete buildings are now under process of construction. This has necessitated the enlargement and extension of the heating, power, water, and sewer systems, all of which has been done during the year. Much new equipment has been added and the farm conditions generally improved.

Assignment.—L. C. Corbett, E. C. Butterfield, J. C. Criswell.

Proposed expenditures, 1915–16.—$29,280.

[Research.]

EXPERIMENTAL GARDENS AND GROUNDS.

General Care of Greenhouses and Grounds:

Object.—To maintain a range of 30 greenhouses for general hybridization work; seed testing; experimental work with collections of citrus and other tropical fruits; the propagation of plants for ornamenting the grounds of the department and those of the Weather Bureau; miscellaneous experimental work; propagation of plants for congressional distribution; experimental work with vegetables; experimental work with florists' crops, including roses, carnations, and chrysanthemums; plant-breeding work; pathological experimental work of the bureau; also the maintenance of the department grounds in good condition.

Location.—Washington, D. C.

Date begun.—1862.

Assignment.—Edward M. Byrnes.

Proposed expenditures, 1915–16.—$53,630.

[Research.]

FOREIGN SEED AND PLANT INTRODUCTION.

GENERAL DIRECTION OF PLANT INTRODUCTIONS.

Administration:

Object.—To secure new and valuable seeds and plants for the department experts, experiment stations, agricultural schools and colleges, plant breeders, public and private experimenters, parks, etc., of this country; the careful placing of same; supervision of office force; maintenance of a large collection of photographs illustrating useful foreign plants and plant industries; and maintenance of a plant quarantine house in accordance with rules and regulations of the Federal Horticultural Board.

Procedure.—By means of extensive correspondence and shipping arrangements abroad and through frequent inquiries with our own State experiment stations, parks, botanic gardens, and private individuals, plants are imported which the experimenters of the country are interested in testing and new possibilities are brought to their attention. From time to time the results obtained from these experiments are ascertained.

Cooperation.—Department officials, experiment stations, botanic gardens, agricultural schools and colleges, private individuals, and domestic and foreign institutions.

Location.—Washington, D. C.

Date begun.—1907.

Results.—Over 40,600 varieties of seeds, plants, etc., have been introduced and distributed to experimenters since 1897, when the Section of Seed and Plant Introduction was established.

Assignment.—David Fairchild.

Proposed expenditures, 1915–16.—$30,300.

Plant Inventory and Records:

Object.—To keep records of introductions; prepare and furnish experimenters, plant breeders, and others in foreign countries with explorers' notes indicating material desired for introduction; keep lists of applicants for introductions, of experimenters in this country, and of foreign correspondents; publish quarterly inventories of seeds and plants imported and bulletins of foreign plant introductions; maintain an extensive seed collection; and to conduct domestic investigations of introduced plants.

Plant Inventory and Records—Continued.

Procedure.—All importations are opened and inspected by pathological and entomological inspectors of the Federal Horticultural Board. These various introductions are given distinctive numbers, and all information available referring to the introduction is recorded on a card bearing this number and filed. An inventory is published quarterly containing all the introductions received during that period. A bulletin of foreign plant introductions is sent out monthly to cooperators, listing the special introductions received. Lists of applications for newly introduced material, of domestic experimenters and foreign correspondents, and a record of all material distributed are kept.

Cooperation.—State experiment stations and private individuals.

Location.—Washington, D. C.

Date begun.—1908.

Results.—Over 40,600 introductions have been received and recorded, and a card record kept of the distribution of all this material. Over 2,000 introductions were made in the past year and 171,831 experimental plants and 11,465 packets of experimental seed placed with experimenters and a record kept of each.

Assignment.—David Fairchild, S. C. Stuntz, H. C. Skeels.

Proposed expenditures, 1915–16.—$15,530.

Total, General Direction of Plant Introductions, $45,830.

FOREIGN EXPLORATIONS.

Major Foreign Explorations:

Object.—To explore the plant industries of foreign countries with a view to securing new varieties of plants and data which will aid in their establishment in America, as well as to discover the wild relatives of cultivated plants useful for breeding with them.

Procedure.—This includes the work of expeditions and special explorers completed with one fiscal year, heretofore appearing as separate yearly projects. Investigations are carried on by consular officials and members of foreign agricultural institutions. These expeditions are sent out under authorized arrangements made during the year to meet unusual opportunities that arise.

Cooperation.—Various bureaus and offices of the department, foreign agricultural institutions, and United States consular officials abroad.

Location.—Washington, D. C.

Date begun.—1913.

Results.—An expedition to the Bahia navel-orange region of Brazil determined the variability of this variety and its origin; it also secured a large number of new forage grasses, fruits, and ornamental plants. An explorer in Nubia secured offshoots of valuable date varieties and other dry-land plants. An exploring party in Guatemala secured plant material of special hard-shelled varieties of the avocado, a new salad palm, and other subtropical fruits. On account of the unsettled conditions abroad this past year by reason of the war, it was impossible to do the exploring contemplated. An investigation was made of the East Indian mangos in Florida and Cuba. An investigation was made of the mango regions of India and an exploration made of southern and central China in search of new wet-land plants and crops suitable to the Gulf States, such as the south China wood-oil tree, persimmons, timber bamboos, water chestnuts, litchis, edible-fruited oaks, southern peaches and plums, taros, dasheens, and numerous other crops.

Assignment.—David Fairchild, Wilson Popenoe.

Proposed expenditures, 1915–16.—$15,800.

Minor Foreign Explorations:

Object.—To secure, through special arrangements by correspondence, rare and valuable seeds and plants from foreign countries, and to prosecute a seed and plant exchange.

Procedure.—This project is carried on by correspondence with private individuals, missionaries, American consuls, collaborators, special experimenters, and foreign botanic gardens and agricultural institutions, and

Minor Foreign Explorations—Continued.

by the exchange of domestic seeds and plants, with a view to securing plant material likely to prove valuable in this country.

Cooperation.—Collaborators, consuls, missionaries, special experimenters, and foreign correspondents.

Location.—Washington, D. C.

Date begun.—1907.

Results.—A correspondence list has been established with the principal plant experts of the world, and through them have been secured thousands of new introductions, such as new grapes, forage crops, grains, beans, fruits, etc. During the past year over 500 shipments of experimental seeds and plants have been made to foreign agricultural institutions in exchange for material sent to this country by them. Some of these have constituted gifts of great importance to the agriculturists of these countries.

Assignment.—David Fairchild.

Proposed expenditures, 1915–16.—$5,200.

Northwestern China Explorations:

Object.—The exploration of Russia, Siberia, Manchuria, and China for plant introductions adapted to the Mississippi Valley and northwestern Great Plains.

Procedure.—A careful field study is made of the agriculture of the region explored, propagating and herbarium material is gathered of promising new plants found, photographs made of all new plants or plant industries discovered, and extensive notes taken regarding all important agricultural practices.

Cooperation.—Russian and Chinese Government officials, American and foreign consular officers, and private individuals.

Location.—Russia, Siberia, Manchuria, and China.

Date begun.—1912.

Results.—During the operation of this project Mr. Meyer has discovered that the chestnut bark disease exists in China, but fails to destroy there a more or less resistant species, seeds of which he has introduced. He has discovered and imported large-fruited varieties of the Chinese jujube, a new fruit tree for the arid West, and has discovered and procured seeds of a new wild peach, a late-flowering wild almond, and a wild hardy pear of the melting-flesh type which may prove valuable as stocks. He has explored the Kansu Province bordering on Tibet and discovered and procured there numerous hardy forest trees, nut trees, wild fruit trees, and shrubs for use as plant-breeding material for parks and street purposes and for dooryard planting. He has also secured and imported a collection of Siberian tree seeds, a hardy bush plum from Siberia, and a bush cherry from China.

Probable date of completion.—Mr. Meyer is expected back in July, 1915, and he will remain in America for approximately one year preparing for further explorations, either in North China or elsewhere. The project for the time being may therefore be considered closed.

Assignment.—David Fairchild, Frank N. Meyer.

Proposed expenditures, 1915–16.—No allotment; work temporarily suspended.

Total, Foreign Explorations, $21,000.

PLANT-INTRODUCTION FIELD INVESTIGATIONS.

Chico Plant-Introduction Field Station:

Object.—To receive, record, propagate, test, and distribute valuable seeds and plants.

Procedure.—Incoming seeds, plants, and plant material are sent to this station and recorded. This material is planted out, tested preliminarily, and propagated. It is then distributed into the sections of the country deemed suitable to its growth, for further testing.

Location.—Chico, Cal.

Date begun.—1904.

Results.—During the year 1914–15 several hundred thousand plants were propagated and between 125,000 and 140,000 distributed, including a large

Chico Plant-Introduction Field Station—Continued.

number of figs, pistaches, grapes, jujubes, plants of *Amygdalus davidiana*—a drought and cold resistant Chinese peach stock—a Chinese chestnut more or less resistant to the chestnut blight, shade trees, forage plants, and dooryard shrubs for dry and arid regions.

Assignment.—David Fairchild, P. H. Dorsett, Peter Bisset, R. L. Beagles

Proposed expenditures, 1915–16.—$13,500.

Miami Plant-Introduction Field Station:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Location.—Miami, Fla.

Date begun.—1907.

Results.—In previous years a large number of tropical and semitropical plants have been tested and distributed, including the mango, avocado, papaya, carissa, anona, and guava. The papaya has been propagated by grafting, experiments conducted on the mango, spraying carried on for the prevention of fungous diseases, and soil conditions improved by the use of new leguminous plants. Twenty-five acres additional have been secured for future work and development of the same started. Owing to the quarantine of this garden on account of citrus canker, no distribution was made this past year. Nearly 6,000 plants were available for this purpose.

Assignment.—David Fairchild, P. H. Dorsett, Peter Bisset, Edward Simmonds.

Proposed expenditures, 1915–16.—$6,100.

Brooksville Plant-Introduction Field Station:

Object.—To grow, propagate, experiment with, and distribute bamboo and other new and useful plants.

Procedure.—Plantings of bamboo, dasheen, and other plants have been made and plants and tubers propagated and distributed into sections of this country deemed suitable for their growth and further testing.

Location.—Brooksville, Fla.

Date begun.—1909.

Results.—Bamboo plantings have been made, and during the past year 5,500 plants were distributed. Citrus and dasheens (a new root crop) were planted. Owing to the presence of nematodes in the dasheens, no extensive distribution of tubers was possible for planting purposes, though 5,000 pounds were sent out for eating purposes. New forage crops have been tested and propagated.

Assignment.—David Fairchild. P. H. Dorsett, Peter Bisset, E. R. Johnston.

Proposed expenditures, 1915–16.—$5,000.

Rockville Plant-Introduction Field Station:

Object.—To receive, record, propagate, test, and distribute valuable seeds and plants.

Procedure.—Incoming seeds, plants, and plant material are sent to this station and recorded. This material is planted and tested preliminarily. It is then propagated and distributed to sections of the country deemed suitable for its growth and further testing.

Location.—Near Rockville, Md.

Date begun.—1910.

Results.—During the year 1914–15 over 100,000 plants were propagated and approximately 80,000 distributed, including a large number of grapes, windbreak plants, dry-land Chinese poplars, drought-resistant peach stocks, Chinese chestnuts more or less resistant to the bark disease, the Karagatch elm of Turkestan, and the Jaboticaba, or cherry, of Brazil.

Assignment.—David Fairchild, P. H. Dorsett, Peter Bissett, J. M. Rankin.

Proposed expenditures, 1915–16.—$14,000.

Avocado Introduction:

Object.—To introduce, test, propagate, and distribute rare and valuable varieties of avocados (alligator pears) and establish avocado culture on a commercial basis in the United States.

Procedure.—Better and hardier strains and varieties from other countries are introduced, fruited, and compared with varieties already established and grown in this country.

Cooperation.—West India Gardens, Altadena Cal.; private cooperators in Florida and California.

Avocado Introduction—Continued.

Location.—Plant-introduction field stations, Miami, Fla., Chico, Cal., and Rockville, Md.

Date begun.—1909.

Results.—Several hundred introductions have been made for propagation, testing, and distribution, including hard-shelled, late-maturing varieties from Guatemala.

Assignment.—David Fairchild, Edward Simmonds.

Proposed expenditures, 1915–16.—Nominal; included in amounts allotted to field stations.

Udo Introduction:

Object.—To demonstrate the possibility of the successful commercial growing of this Japanese vegetable and to secure the best varieties for cooperative work.

Procedure.—The best known strains from Japan are introduced, propagated, and distributed.

Location.—Plant-introduction field stations, Rockville, Md., and Chico, Cal.

Date begun.—1902.

Results.—About 25,000 plants were propagated during the past two years; these and a large number of packets of seed were distributed to persons throughout the United States. Eight named varieties from Japan were introduced and tested at the Rockville station.

Assignment.—David Fairchild.

Proposed expenditures, 1915–16.—Nominal; included in allotments for field stations.

Mango Introduction:

Object.—To encourage the establishment of commercial mango growing in this country.

Procedure.—New varieties of this fruit are introduced, propagated, and distributed. These varieties are also fruited and compared with varieties already grown in this country.

Cooperation.—West India Gardens, Altadena, Cal.; private experimenters and cooperators.

Location.—Plant-introduction field stations, Miami, Fla., Chico, Cal., and Rockville, Md.; Homestead and Miami, Fla., Altadena, Cal., and other points in these States where private experimenters are conducting tests.

Date begun.—1900.

Results.—Over 400 different introductions have been propagated, tested, and distributed, resulting in bearing trees and groves scattered throughout Florida. Field investigations have been made in Florida, Cuba, Isle of Pines, and Porto Rico to discover the causes of the failure of certain varieties to bear.

Assignment.—David Fairchild, Edward Simmonds, Wilson Popenoe.

Proposed expenditures, 1915–16.—Nominal; included in allotments for field stations.

Dasheen Introduction:

Object.—To introduce a tuberous root crop into the warmer, moist sections of the United States, where climatic conditions make the growing of the Irish potato impracticable or uncertain, and especially where the potato can not be grown as a fall crop.

Procedure.—New varieties are introduced from foreign countries and tested in comparison with varieties already grown in this country. These varieties are improved by selection. Large numbers of dasheen tubers are propagated and distributed to private cooperators for planting and for experimental table use. Experiments are conducted to determine the best methods of cooking and serving dasheen tubers, flour, leaves, and blanched shoots. Limited quantities of tubers are distributed to the domestic science departments of State universities and other cooking schools and to leading clubs, hotels, and restaurants, when their cooperation can be secured, in an effort to establish a market for the dasheen.

Location.—Washington, D. C.; plant-introduction field station, Brooksville, Fla.; private growers in the Southern and Gulf States.

Date begun.—1905.

Dasheen Introduction—Continued.

Results.—Owing to the discovery of root-knot in the crop harvested in the fall of 1914 it was impracticable to make extensive distributions for planting purposes in the South, as in previous years. Over 10,000 pounds of tubers were distributed for eating purposes in the Northern States and for stock-feeding experiments in the South. Field and storage investigations were made of the crop; also extensive cooking tests, as a basis for the selection of better strains. Limited markets have been developed in a few northern cities.

Probable date of completion.—1918.

Assignment.—David Fairchild, R. A. Young, E. R. Johnston.

Proposed expenditures, 1915-16.—$3,040.

Bamboo Introduction:

Object.—To introduce and establish the edible and timber bamboos in sections of the United States where these plants will succeed and to encourage their planting in commercial quantities.

Procedure.—The bamboo plants are introduced and propagated and the rhizomes distributed. Cooperation is arranged with American manufacturers using bamboo, relative to the utilization of domestic-grown cane. The utilization of bamboo shoots as a vegetable is being exploited.

Cooperation.—The McIlhenny Co., Avery Island, La.

Location.—Plant-introduction field stations, Brooksville, Fla., Chico, Cal., and Rockville, Md.; and Avery Island, La.

Date begun.—1907.

Results.—Over 100 different introductions have been tested; 3 acres of timber bamboos are now growing at the Brooksville station; experimental plantings of both edible and timber bamboo have been made at Avery Island, La.; 4,500 plants were distributed from Brooksville in 1915.

Assignment.—David Fairchild, P. H. Dorsett, Peter Bisset, S. C. Stuntz, E. R. Johnston.

Proposed expenditures, 1915-16.—Included in field-station allotments.

Litchi Introduction:

Object.—To introduce and establish this Chinese fruit in the United States.

Procedure.—Improved varieties are introduced and seedling and budded plants propagated and distributed.

Location.—Plant-introduction field stations, Miami, Fla., Chico, Cal., and Rockville, Md.

Date begun.—1907.

Results.—About 50 different introductions have been propagated and distributed. Trees growing at Oneco and Tampa, Fla., may prove this tree to be hardier than expected.

Assignment.—David Fairchild.

Proposed expenditures, 1915-16.—Included in field-station allotments.

Chayote Introduction:

Object.—To place better strains and varieties in the hands of cooperators and experimenters throughout the southwestern section of the United States.

Procedure.—The project involves the introduction, propagation, and distribution of better and improved strains.

Location.—Plant-introduction field stations. Chico, Cal., Rockville, Md., and Brooksville, Fla.

Date begun.—1910.

Results.—Large numbers of plants and seeds introduced and distributed to experimenters. Best varieties of chayotes grown and tested at Brooksville station. No fruits distributed, as the entire crop was retained for propagation in 1916.

Assignment.—David Fairchild.

Proposed expenditures, 1915-16.—Included in field-station allotments.

Almond Introduction:

Object.—To secure and introduce better varieties of almonds.

Procedure.—The work consists of the introduction, propagation, and distribution of improved varieties.

Location.—Plant-introduction field stations, Chico, Cal., and Miami, Fla.

Date begun.—1907.

Almond Introduction—Continued.

Results.—The hard-shelled Spanish almonds have been introduced and tested, and experiments are under way with Chinese bush almonds, new possibilities for the Southwest. Over 100 different introductions have already been made.

Assignment.—David Fairchild.

Proposed expenditures, 1915–16.—Included in field-station allotments.

Wood-Oil Tree Introduction:

Object.—To introduce, establish, and grow wood-oil trees commercially in the United States.

Procedure.—Introductions are made of the plants, which are then propagated and the seedlings distributed. An attempt to increase their oil content by selection and breeding is being made.

Location.—Plant-introduction field stations, Brooksville, Fla., and Chico, Cal.; and collaborators and private individuals in Florida, California, Alabama, and Georgia.

Date begun.—1905.

Results.—All plants grown at the Brooksville station in 1914–15 were held, owing to the presence of root-knot, and very few trees were distributed from other gardens. A large quantity of seed has been secured and is being propagated, and it is intended to make a wide distribution of 1-year-old seedlings in the spring of 1916. Several private plantings, the largest consisting of 40 acres, are under supervision near Tallahassee, Fla. Two-year-old trees bore fruit last season.

Assignment.—David Fairchild, R. A. Young.

Proposed expenditures, 1915–16.—Included in field-station allotments.

Introduction of Chinese Jujubes:

Object.—To introduce this valuable hardy orchard fruit tree into the semiarid sections of the United States.

Procedure.—The different varieties of this valuable fruit (*Zizyphus jujuba*) collected and sent in by Mr. Frank N. Meyer, the bureau's explorer in China, are being propagated and distributed.

Location.—Plant-introduction field stations, Chico, Cal., and Rockville, Md.

Date begun.—1910.

Results.—Prepared Chinese jujubes are as palatable as dates. A careful investigation has been made of the jujube industry of China, including the methods of culture, preparation for market, and varieties grown. Over 50 varieties of this new fruit have been introduced, including practically seedless forms and large-fruited, fine-flavored varieties.

Assignment.—David Fairchild, P. H. Dorsett, Peter Bisset.

Proposed expenditures, 1915–16.—Included in field-station allotments.

Introduction of Carob Trees:

Object.—To import, propagate, and distribute the most promising productive varieties of this important forage tree, and to determine the best pollinating varieties and the best methods of establishing orchards in this country.

Procedure.—The best known varieties and highest yielding strains are imported from Spain and other countries of southern Europe. These are propagated and the seedlings and budded trees distributed.

Location.—Plant-introduction field station, Chico, Cal.

Date begun.—1910.

Results.—The best Spanish, Portuguese, Algerian, and Grecian varieties have been introduced, and seedling trees in southern California have been grafted with these better yielding sorts, which produce sweeter and more nutritious pods, and much interest in this drought-resistant, long-lived forage tree has been aroused.

Assignment.—David Fairchild, P. H. Dorsett, R. L. Beagles.

Proposed expenditures, 1915–16.—Included in field-station allotment.

Persimmon Introduction:

Object.—To introduce better yielding, longer lived, larger fruited, and less astringent varieties of the oriental persimmon, or *Diospyros kaki*, and the stocks upon which to grow them.

Procedure.—Seeds and cuttings of these forms are introduced from China, Japan, and the oriental Tropics. The plants are then propagated and

Persimmon Introduction—Continued.

distributed. An investigation of the oriental persimmon industry is made by explorers and correspondents.

Cooperation.—State experiment stations and private experimenters.

Location.—North Carolina, Florida, Georgia, and California.

Date begun.—1910.

Results.—Field investigations were made of persimmon regions in China by Mr. Frank N. Meyer, agricultural explorer, in conjunction with his explorations in northwestern China. A large collection of photographs of Chinese types and orchard methods were received from Mr. Meyer, together with specimens of dried persimmons, persimmon sugar, and specimens preserved in alcohol, and data on the methods used by the Chinese in making persimmon brandy, persimmon vinegar, etc. Over 400 introductions have been propagated and distributed, including the large seedless Tamopan variety, remarkable for its nonastringent character.

Assignment.—David Fairchild.

Proposed expenditures, 1915–16.—Included in field-station and "Major foreign explorations" allotments.

Introduction of Street and Park Plants:

Object.—To introduce, propagate, and distribute new and rare varieties of shrubs, trees, and other plants for testing to determine their economic importance for civic-improvement purposes and for use in dooryard gardens.

Procedure.—This includes the introduction, propagation, and distribution of new and rare shrubs, trees, and other plant material deemed valuable as additions to those already grown in this country.

Cooperation.—Private experimenters, nursery firms, park superintendents, civic-improvement societies, and other domestic institutions.

Location.—Washington, D. C., and plant-introduction field stations.

Date begun.—1911.

Results.—Hundreds of varieties of trees and shrubs have been introduced, propagated, and placed in experimenters' hands for trial. Those sent out for testing last year include new or rare forms of ornamental vines, such as Actinidia, Clematis, Ipomoea, and Camoensia; shrubs and small trees adapted to dooryard and park uses, such as barberries, Japanese flowering cherries, oleasters, honeysuckles, cedars, and hardy roses; and street and windbreak trees, such as oaks, pines, poplars, willows, elms, and tamarisks, many of which are adapted to cultivation in the semiarid regions of the Southwest and the northern Great Plains region.

Assignment.—David Fairchild, Peter Bisset.

Proposed expenditures, 1915–16.—Included in field-station allotments.

Date-Palm Introduction:

Object.—To import varieties of dates and to establish date growing on a commercial basis in such sections of the United States as are adapted to the growth and development of the trees.

Procedure.—Date seed and offshoots are introduced through correspondents and by sending expeditions after new varieties.

Location.—Washington, D. C.

Date begun.—1899.

Results.—Importations have been made from Egypt, Algeria, Tunis, Morocco, Nubia, and from the oases of the Great Sahara.

Assignment.—David Fairchild.

Proposed expenditures, 1915–16.—Included in allotment for "Major foreign explorations."

Introduction of Pistache Nuts:

Object.—To introduce from foreign countries improved varieties of the pistache and propagate the same for distribution.

Procedure.—Promising varieties are introduced, propagated, and distributed.

Location.—Washington, D. C., and plant-introduction field stations.

Date begun.—1910.

Results.—Superior budded varieties and stocks have been distributed in quantity.

Assignment.—David Fairchild.

Proposed expenditures, 1915–16.—Included in field-station allotments.

Papaya Introduction:

Object.—To discover and disseminate superior varieties of the papaya with fruit having a better flavor and better shape for shipping purposes than the ordinary seedling papaya; to investigate the best methods of propagating the papaya in order to prevent the deterioration of varieties; to disseminate other species of Carica of possible use for breeding with *Carica papaya;* and by the extensive distribution of plants to discover regions in the Southern States where the papaya may be grown and fruited as an annual plant.

Procedure.—Includes the introduction, propagation, testing, and distribution of grafted plants and seedlings.

Location.—Washington, D. C., and plant-introduction field station, Miami, Fla.

Date begun.—1912.

Results.—Nearly 200 introductions have been made; thousands of plants (seedlings) and many packets of seed distributed, also grafted plants in limited numbers to special cooperators; correspondence conducted with manufacturing chemists regarding the establishment of commercial plantings of *Carica papaya* for the production of papain; data in B. P. I. Circular 119, "The Grafted Papaya as an Annual Fruit Tree."

Assignment.—David Fairchild, Edward Simmonds.

Proposed expenditures, 1915–16.—Included in field-station allotments.

Minor Plant Introductions:

Object.—To introduce, propagate, and distribute seeds and plants other than those covered in specific projects. This project covers improved or experimental forms of the following: Feijoa, loquat, annonaceous fruits, Carissa, guava, apples, pears, peaches, and cherries; *Amygdalus davidiana* and Prunus stocks; wild relatives of economic plants for breeders; and the Jaboticaba and other Brazilian fruits.

Procedure.—Seeds, plants, and plant material deemed of sufficient value to warrant their addition to those already grown in this country are introduced, propagated, and distributed.

Cooperation.—State experiment stations, parks, and other domestic institutions, and private individuals and cooperators.

Location.—Washington, D. C., and plant-introduction field stations.

Date begun.—1910.

Results.—A great quantity of miscellaneous seeds and plants has been introduced, propagated, and distributed.

Assignment.—David Fairchild, P. H. Dorsett, Peter Bisset.

Proposed expenditures, 1915–16.—$1,790.

Total, Plant-Introduction Field Investigations, $43,430.

Total, Foreign Seed and Plant Introduction, $110,260.

[Research.]

FORAGE-CROP INVESTIGATIONS.

Supervision:

Object.—To supervise the investigational work in connection with forage-crop production and perform administrative and routine clerical work incidental thereto.

Location.—Washington, D. C.

Date begun.—1905.

Assignment.—C. V. Piper.

Proposed expenditures, 1915–16.—$16,110.

Alfalfa Investigations:

Object.—To test and develop by breeding and selection and to establish new varieties of alfalfa, especially hardy and drought-resisting strains suitable for the Southwest, and to extend the profitable culture of alfalfa in the East.

Procedure.—In conducting the investigations indicated above, a definite plan has been adopted so that the same methods can be followed at the various points where the work is being done. In conducting the investigations, sufficient replication and a sufficient number of checks are employed to make the results dependable. No experiments are outlined unless the results obtained may answer problems of definite agronomic

Alfalfa Investigations—Continued.

importance. The factors which determine the work to be done are the immediate needs of the section and the adaptability of the section to the solution of the problem.

Cooperation.—Bureau of Entomology at Murray, Utah, in connection with weevil investigations; Colorado, Montana, Kansas, and Texas experiment stations; and private individuals in the East.

Location.—Redfield, S. Dak.; Moccasin, Mont.; Aberdeen, Idaho; Rocky Ford, Colo.; Murray, Utah; Chico, Cal.; Hays, Kans.; Amarillo and Chillicothe, Tex; and various points in Pennsylvania, New Jersey, Delaware, Maryland, Virginia, and North Carolina.

Date begun.—1905.

Results.—Some of the results of this work are published in Farmers' Bulletins 339 and 495; B. P. I. Bulletins 169, 115, and 119; B. P. I. Circular 24; and Department Bulletin 75. Investigations heretofore conducted at Brookings, Highmore, and other points in South Dakota were transferred to Redfield, S. Dak., where a new station was established, 50 acres in area; the first year's work at the station was very encouraging. The work at Hays, Kans., and at Amarillo and Chillicothe, Tex., was conducted as previously outlined, but, on account of unfavorable climatic conditions, the data procured from the experiments were far from complete. Some new investigations were inaugurated at Newell, S. Dak., with a view to determining the drought resistance of various commercial strains. The varieties for the first season range in yield as follows: Baltic, Canadian Variegated, Grimm, Cherno, Kansas grown, and Semipalatinsk. The Turkestan variety included in the test was entirely destroyed by rabbits. In practically all the tests of alfalfa varieties in the West, Turkestan has been injured by rabbits to a much greater extent than any of the other varieties.

Probable date of completion.—1925.

Assignment.—R. A. Oakley, H. L. Westover, Samuel Garver, Leroy Moomaw.

Proposed expenditures, 1915–16.—$10,900.

Clover Investigations:

Object.—To develop by breeding and selection hardy, heavy-yielding strains of clovers with desirable seed and forage qualities; to determine the relative merits of various varieties of clover and cloverlike plants; to determine the causes and means of overcoming clover failures; and to improve the present methods of clover-seed production.

Procedure.—The relative merits of the different sorts of clover are studied most in detail at cooperative testing stations located at regular State experiment stations. The most promising of these strains are then put out in larger plat and field tests with suitably located cooperative farmers. The cultural requirements of clovers are determined in a preliminary way from a large number of experimental plats at the cooperating experiment stations, and the most promising treatments are tried out by numbers of cooperating farmers in the sections in question. The factors which underlie successful seed production are determined in part by a field study of all the harvested seed yields in a given community as compared with the seed failures in the same community, to determine the different methods of treatment and to determine from this study the conditions presented in common by the fields giving the best yields of seed. The work of breeding improved strains of clover is carried out by selecting the most promising individuals from the variety-testing plats and comparing them with individual selections in the various clover fields.

Cooperation.—Indiana, Iowa, and North Dakota experiment stations; individual farmers throughout the northern and eastern parts of the United States.

Location.—Lafayette, Ind.; Ames, Iowa; Fargo, N. Dak.; New London, Ohio; Arlington, Va.; and various points throughout the eastern and northern parts of the United States.

Date begun.—1905.

Results.—The experiments in mechanical pollination have indicated that no mechanical device has as yet been found for cross-pollinating red clover on a large scale. Selections were made of promising strains of

Clover Investigations—Continued.

red clover. Improved forms of the comb stripper were developed, which will enable any farmer to use a home-built machine at a very slight expenditure of time and labor. In cooperation with the Office of Agricultural Technology, an improved brush stripper has been given a preliminary trial, and a machine ready for patenting is nearly completed. The work with sweet clover consisted in the encouragement of farmers, especially in determining the best methods of harvesting sweet-clover seed. Seed production of Ladino white clover is being fostered in Idaho. A number of cloverlike plants have been under test to determine under what conditions they can be used as substitutes for red clover, especially under conditions where red clover has not been a success. Among these may be mentioned yellow trefoil, which appears to be promising in the States immediately north of the Ohio River for seeding in corn at the last cultivation. In connection with the problem of clover failure, a series of pot experiments in the greenhouse with soils from known clover-sick areas was inaugurated. Investigations were conducted in connection with clover-seed production, and it is hoped that the seed-production business may be made less precarious for the ordinary farmer. Data in Farmers' Bulletins 455, 485, 550, 579, and 646.

Probable date of completion.—1920.

Assignment.—C. V. Piper, H. S. Coe.

Proposed expenditures, 1915–16.—$7,900.

Sorghum Investigations:

Object.—To determine the best methods of culture, test promising imported varieties, breed strains better adapted to local conditions, and determine the silage value of sorghum as compared with corn and other crops.

Procedure.—Investigations are conducted at the various stations to ascertain the best methods of culture and to try out new and promising varieties. Experiments are also conducted with reliable farmers.

Cooperation.—Texas, Kansas, and South Dakota experiment stations.

Location.—Arlington, Va.; Chillicothe and Amarillo, Tex.; Hays, Kans.; and Redfield, S. Dak.

Date begun.—1905.

Results.—Data published in Farmers' Bulletin 458 and B. P. I. Circular 122. During the past year methods were inaugurated for minimizing sources of error in experimental work. Feterita proved to be of great value. The selection and hybridization of sorghum varieties were continued, and a study of the inheritance of characters is in progress to obtain more valuable strains.

Probable date of completion.—1925.

Assignment.—H. N. Vinall, R. W. Edwards, A. B. Cron. R. E. Getty.

Proposed expenditures, 1915–16.—$5,400.

Dry-Land Forage Crops Other than Sorghums:

Object.—To test all forage crops believed to be of value in dry-land agriculture, improve standard crops by breeding, and determine the best cultural methods for such crops.

Procedure.—Row and plat tests, in case of new crops, and variety trials are followed by field tests of the most promising sorts. After this second elimination, those proving valuable will be given cooperative demonstration tests with farmers. Seed production, methods of cultivation, and combinations of legumes and nonlegumes are points of special study.

Cooperation.—Texas, Oregon, and Kansas experment stations, and individual farmers throughout the Great Plains area.

Location.—Hays, Kans.; Chillicothe and Amarillo, Tex.; and Moro, Oreg.

Date begun.—1908.

Results.—Data in B. P. I. Circular 80 and Farmers' Bulletin 101. The most important work accomplished with this project has been the results obtained in investigations with millets and field peas, the results of which are now ready for publication. Plants from hybrids of Tunis grass and sorghum were of much interest the past year, and selections from the same give promise of becoming quite valuable hay crops.

Probable date of completion.—1925.

Assignment.—H. N. Vinall, R. W. Edwards, A. B. Cron, R. E. Getty.

Proposed expenditures, 1915–16.—$7,700.

Timothy Breeding:

Object.—To secure by breeding and to establish agriculturally improved strains of timothy.

Procedure.—In the timothy-breeding work selections are made in various parts of the country under different conditions and the plants propagated vegetatively in rows. Seed is then saved from these plants in order to determine whether it will breed true to type. Coincident to this, close-fertilized seed is secured and tested in comparison with the open-fertilized seed. Two generations of close-fertilized seed are considered sufficient to secure a homozygous strain. After this has been accomplished the selection is tested under field conditions and, if valuable, the stock of seed is increased for testing among farmers.

Cooperation.—Ohio Experiment Station.

Location.—Elyria, Ohio (station moved from New London, Ohio).

Date begun.—1905.

Results.—Data published in Farmers' Bulletin 502. During the season of 1914 the selections of timothy growing in row plats and in broadcast plats at New London, Ohio, were studied and compared. The study of the life history of timothy was continued. Extended observations were also made on the blooming and pollination of timothy. A large number of samples of timothy hay were collected and weighed, as material to be used in the investigation of the moisture content of hay.

Probable date of completion.—1919.

Assignment.—R. A. Oakley, M. W. Evans.

Proposed expenditures, 1915–16.—$2,200.

Pasture Investigations:

Object.—To determine the best methods of handling pastures so as to secure the maximum carrying capacity.

Procedure.—Tests are conducted to determine the practicability of reseeding permanent meadows without breaking up the sod. A specific pasture experiment is conducted at Blacksburg, Va., on an area of 20 acres, which is fenced into eight fields. Various cultural treatments are tested; also alternate grazing, light and heavy grazing, and the effects of fertilizer and reseeding.

Location.—Blacksburg, Va.; Maryland, Tennessee, Missouri, New Jersey, New York, Illinois, and Indiana.

Date begun.—1909.

Results.—A paper entitled "Management of Bluegrass Pastures" was prepared in cooperation with the Virginia Experiment Station and published as Bulletin 204 of that station. Preliminary pasture surveys were made with a view to considerably enlarging the scope of pasture investigations in the future.

Probable date of completion.—1920.

Assignment.—Lyman Carrier.

Proposed expenditures, 1915–16.—$3,600.

Sudan Grass:

Object.—To determine the agronomic value of this newly introduced grass and to secure disease-resistant strains.

Procedure.—Tests are made with the grass in various sections of the country to determine its value. Promising related strains of the grass are also tested.

Cooperation.—Temporary cooperation with several State experiment stations, including practically all in the semiarid regions, and with farmers.

Location.—Arlington, Va.; Gainesville, Fla.; Baton Rouge, La.; Chillicothe and Amarillo, Tex.; Hays, Kans.; Redfield, S. Dak.; and Moro, Oreg.

Date begun.—1909.

Results.—Unprecedented popularity has attended the introduction of this grass. The results obtained this year fully justify the previous good impression created. Yields of 8.18 tons of field-cured and 5.47 tons of air-dry hay were obtained at Chillicothe, Tex., and 5.5 tons of field-cured and 4.09 tons of air-dry hay at Hays, Kans. The grass will be quite widely distributed this year and should in a short time become one of our chief hay grasses. Data published in Farmers' Bulletin 605 and B. P. I. Circular 125.

Probable date of completion.—1920.

Assignment.—H. N. Vinall.

Proposed expenditures, 1915–16.—$1,000.

Rhodes Grass:

Object.—To determine the agronomic value of this newly introduced foreign grass.

Procedure.—Investigations are being conducted along the line of cultural treatment, including cultivation and the use of fertilizers.

Cooperation.—Most of the southern experiment stations are carrying out plat work on plans prepared by the department.

Location.—The cotton-growing States, and Arlington, Va. Most of the work is conducted in Florida.

Date begun.—1910.

Results.—Interest in Rhodes grass has greatly increased. Certain difficulties which promised to become definite handicaps to the successful culture of the crop have, in a measure, disappeared, and the results for the past year have been decidedly encouraging. There is little doubt now that Rhodes grass will henceforth be one of the most important hay crops for Florida.

Probable date of completion.—1917.

Assignment.—C. V. Piper, R. A. Oakley.

Proposed expenditures, 1915–16.—$500.

Cowpeas:

Object.—To test and breed new and improved varieties; to determine the best methods of harvesting and thrashing the seed.

Procedure.—New introductions, selections, and hybrids of cowpeas are tested at Arlington, Va. The most promising of these varieties are put out with the southern experiment stations.

Cooperation.—Informal cooperation with various State experiment stations.

Location.—Arlington, Va., and Monetta, S. C.

Date begun.—1905.

Results.—Data in Farmers' Bulletin 318, B. P. I. Bulletin 229, and B. P. I. Circular 124. A large amount of work has been carried on with varieties, selections, and hybrids of this crop. Seed of these early varieties of *Vigna catjang* has been distributed in various sections of the South and gave quite promising results the past season. A large number of hybrids having either the Brabham or Iron as one of the parents were tested in the wilt and nematode infested lands of South Carolina. One of the hybrids, Brabham with Groit, has given a new seed color and appears highly resistant to wilt and nematodes. Some excellent early strains appear in the hybrids where the Early Buff, a promising early strain, was combined with the Brabham, Iron, Groit, and New Era. Not only do some of these early selections appear suitable for northern conditions but also as early strains for the wilt and nematode soils of the South. Extensive work has been continued with the Groit and Brabham varieties. Throughout the area infested by wilt and nematodes these varieties have proved very promising. Also in the Southwest the Brabham has given very great promise. The Groit has proved to be a very promising variety both for forage and seed wherever grown and now occupies an important place in the market. A distribution of the Early Buff was made in the Northern States and found most promising. This variety was found superior in forage, seed yield, and earliness to any variety yet grown in the North. A large quantity of seed has been obtained, so that a greater distribution is planned.

Probable date of completion.—1920.

Assignment.—W. J. Morse.

Proposed expenditures, 1915–16.—$2,000.

Soy Beans:

Object.—To determine the most valuable of the numerous varieties of soy beans, secure new and improved varieties by breeding, determine the best methods of culture and harvesting, and bring about an increased use of the crop, especially for oil-seed production.

Procedure.—New introductions, selections, and hybrids of soy beans are tested at Arlington, Va., and in cooperation with State experiment stations. Seed of the most promising varieties is grown on a field scale, so that seed may be had for a more general distribution.

Cooperation.—A number of State experiment stations.

Location.—Arlington, Va., and various points in the Southern States.

Date begun.—1905.

Soy Beans—Continued.

Results.—Farmers' Bulletin 372 and B. P. I. Bulletin 197 have been published; other publications are in preparation. The work with soy beans during the past year has been quite extensive along the following lines: Variety testing, breeding, methods of culture, and extension. During the season more than 300 new introductions from Manchuria, China, and Japan were added to the variety work. About 50 of this new lot were tested in five Northern States, and several very promising early strains appeared among them. Experimental work has been carried on in the wilt and nematode lands of the South for varieties resistant to disease. Three varieties have been found that appear to resist wilt and nematodes to a considerable extent. At the present time the old commercial varieties have been almost wholly replaced by new varieties introduced through the department. Among the most promising of these varieties are the Haberlandt, Meyer, Peking, Wilson, Jet, Tokio, Auburn, and Austin. Considerable work has been carried on with selection and hybridizing and some rather promising strains developed. In addition to the forage value of the soy bean, analyses are being made of varieties and selections in order to find strains high in percentage of oil. The cooperative work has been principally with the Arlington, Haberlandt, Peking, Virginia, Black Eyebrow, and Manchu varieties. Small distributions of the Arlington and Virginia varieties indicate these to be very promising for forage and seed. The Haberlandt and Peking have a wide distribution and are very successful. The Black Eyebrow and Manchu are from northern Manchuria and have given excellent results with cooperators in New York, New Jersey, Ohio, Wisconsin, Minnesota, and South Dakota. A large amount of this seed was grown, so that a much larger distribution can be made.

Probable date of completion.—1920.

Assignment.—W. J. Morse.

Proposed expenditures, 1915–16.—$2,500.

Velvet Beans:

Object.—To compare different species of Stizolobium and obtain new varieties by breeding, especially with the object of securing a bushy variety.

Procedure.—Promising new and improved varieties of velvet beans are tested at the various testing stations, and varieties that prove their worth are propagated and distributed throughout the South.

Cooperation.—Florida Experiment Station.

Location.—Biloxi, Miss.; Brooksville and Miami, Fla.

Date begun.—1905.

Results.—The Chinese velvet bean has met with remarkable favor throughout the South and is superior to any of the early hybrids yet obtained. It is somewhat objectionable, however, from the fact that the pods shatter readily. During the past season two early varieties of Florida velvet beans have been secured. One of these matures its seed in about 100 days, the other requiring about 120 days. These early varieties have all the good points of the old Florida velvet bean and promise to solve the problem of an early velvet bean even better than the Yokohama and Chinese varieties.

Probable date of completion.—1920.

Assignment.—S. M. Tracy.

Proposed expenditures, 1915–16.—$2,000.

Vetches:

Object.—To test all the different varieties of this crop and to breed improved strains.

Procedure.—Breeding work is conducted, experiments made with different varieties to ascertain their value, and methods of culture studied.

Cooperation.—Informal cooperation with the Oregon Experiment Station and with farmers.

Location.—Chico, Cal.; Corvallis, Oreg.; and Arlington, Va.

Date begun.—1905.

Results.—The testing and study of the many species and varieties of vetch in the various parts of the country has been continued and the extended use of common and hairy vetch encouraged. The year's work has con-

Vetches—Continued.

firmed the conclusions of previous years as to the superior value of purple vetch for green-manuring purposes in the southwestern United States and that the seed can be grown cheaply, especially in Oregon and Washington west of the Cascade Mountains. The growing of this seed on a commercial scale has been encouraged. Bitter vetch has continued to do well in California, and efforts are being made to determine the possibilities of commercial seed production of the crop. The study of the production of Tangier pea seed has been continued. The seed habits of this crop are poor, and the high cost of production of seed is the principal factor in preventing its more extended use. Increased interest in vetches throughout the country shows a fuller appreciation of the value of this crop and indicates the possibilities of a more extended use. Data published in Farmers' Bulletin 515 and B. P. I. Circular 102.

Probable date of completion.—1920.

Assignment.—Roland McKee.

Proposed expenditures, 1915–16.—$3,000.

Range-Land Investigations:

Object.—To determine the carrying capacity of ranges, restore overstocked ranges, and investigate range management under different conditions.

Procedure.—Much of the work is conducted on the Santa Rita Reserve, Ariz., and the Jornada Reserve, N. Mex. Studies are conducted in connection with reseeding worn-out ranges and in the improvement of the range when protected from the depredations of stock. Information is gathered from stockmen regarding methods of handling stock, with a view to maintaining the productiveness of the range, and studies are made to determine the carrying capacity of the range in various sections. Studies are made of the ranges in various parts of the West, with a view to gathering information as a basis for legislation concerning range land, and information is gathered as to the carrying capacity and methods of management used on individual areas.

Cooperation.—Office of Farm Management, Forest Service, and private individuals.

Location.—Mainly in the Southwestern States.

Date begun.—1902.

Results.—During 1914 the usual work at the Jornada, N. Mex., project was carried out. A large recovery pasture was fenced early in the year and a reconnoissance survey made in the summer. Data on feeding cottonseed cake to calves and poor cows were obtained in the spring, and steps were taken to get data on the production of baby beef in the valley, using feeds grown there. The hay cuttings this year were on a larger scale than usual, and data as to the expense involved were obtained. Data as to Arizona desert conditions in early summer were obtained on the Pima Indian Reservation. A thorough study was made of the range stock conditions of eastern, northern, and northwestern Colorado and southern and southeastern Wyoming. B. P. I. Bulletins 4, 15, 38, 67, and 117, and Department Bulletins 201 and 211 have been published.

Probable date of completion.—1920.

Assignment.—David Griffiths, E. O. Wooton.

Proposed expenditures, 1915–16.—$4,020.

Cactus Investigations:

Object.—To study the cactus plant and its use as a forage crop and as human food.

Procedure.—Information is gathered concerning the use of cactus as forage for stock and as human food. Feeding experiments with beef and with dairy cattle are conducted. A study is made of the distribution of the economic species of cactus, and experiments are made in the propagation of the more desirable species. Cactus plantations are made in cooperation with State experiment stations and with farmers.

Cooperation.—Office of Farm Management.

Location.—Mainly in the Southwest and in Mexico.

Date begun.—1902.

Results.—During 1914 three carloads of spineless stock were distributed to people interested in testing the crop on a large scale. Three to five

Cactus Investigations—Continued.
species have been secured which have promise for increasing the hardiness of the spineless forms. Records of the varietal plantings are being kept up and the important things are being figured, both photographically and in color. Data in B. P. I. Bulletins 74, 91, 102, 116, 124, 140, and 177; Farmers' Bulletin 483; and Department Bulletin 31.

Probable date of completion.—1920.

Assignment.—David Griffiths.

Proposed expenditures, 1915–16.—$6,160.

Weed and Tillage Investigations:

Object.—To decide upon the cheapest and most effective methods of eradicating weeds and of tilling the soil.

Procedure.—Field studies and experiments are conducted.

Location.—Headquarters, Washington, D. C.; Pennsylvania, Oregon, Kentucky, Texas, South Carolina, Michigan, Washington, Nebraska, New Hampshire, Connecticut, West Virginia, Ohio, Louisiana, Missouri, Indiana, Maine, and New York; also experimental work at Arlington, Va.

Cooperation.—Office of Farm Management and individual farmers in the States named under "Location."

Date begun.—1905.

Results.—Cooperative experiments on the weed factor in the cultivation of crops were continued during 1914. The field survey of tillage practices with corn in different sections of the United States was completed and a manuscript submitted for publication. The use of explosives as tillage agents was studied by means of experiments, field surveys, and a review of the literature. Experiments in the eradication of fernbrake in pastures were completed and a report prepared. Two satisfactory methods have been found for the eradication of this pest. Studies in the eradication of the shrubby cinquefoil and other shrubby plants and relative to numerous lawn weeds were continued. Nine districts were visited in making a weed survey of the country. Studies of the use of chemical plant poisons were also continued. The following publications have been issued: B. P. I. Document 416, B. P. I. Circular 94, B. P. I. Bulletin 257, and Farmers' Bulletins 279, 368, 464, 545, 610, and 660.

Probable date of completion.—1920.

Assignment.—H. R. Cox, H. R. Cates.

Proposed expenditures, 1915–16.—$9,340.

Total, Forage-Crop Investigations, $84,330.

[Extension.]

SEED DISTRIBUTION.

SUPERVISION.

Supervision:

Object.—Supervision of administrative details relating to the purchase and distribution of vegetable, flower, cotton, tobacco, lawn-grass, and drought-resistant field seeds, bulbs, and plants; handling congressional correspondence and franks; and supervision of the personnel of the office.

Procedure.—This work is carried on in three sections, one section of the office taking care of the details in connection with the purchase and distribution of vegetable, flower, cotton, tobacco, and lawn-grass seed, and bulbs; a second section taking care of the congressional correspondence in connection with the distribution of the vegetable, flower, and lawn-grass seed; and another section taking care of the details relating to the purchase and distribution of drought-resistant field seeds and the handling of the congressional correspondence and franks in connection therewith.

Location.—Washington, D. C.

Date begun.—Distribution inaugurated in the Patent Office in 1839, transferred to the Department of Agriculture in 1862, and transferred to the Bureau of Plant Industry in 1902.

Assignment.—R. A. Oakley.

Proposed expenditures, 1915–16.—$50,260.

CONGRESSIONAL DISTRIBUTION.

Vegetable and Flower Seeds:

Object.—Purchasing, testing, packeting, franking, assembling, and mailing vegetable and flower seeds for congressional distribution.

Procedure.—All seeds are purchased through competitive bids obtained from the principal seed growers and dealers in this and foreign countries. All purchases are made subject to satisfactory appearance, germination, and trueness to varietal name or type. The testing of samples of seed to ascertain its viability is done by experts in the Seed-Testing Laboratory both before and after the shipment of the bulk seed. The seeds are packeted, assembled, and mailed by contract, at a daily output of 138,000 packages.

Location.—Washington, D. C.

Date begun.—Patent Office, 1839; Department of Agriculture, 1862; Bureau of Plant Industry, 1902.

Results.—Encouragement of home gardens in the United States by the distribution of standard varieties of vegetable and flower seeds of known value and of the best quality. Data published in B. P. I. Circular 100, "Distribution of Seeds and Plants by the Department of Agriculture."

Assignment.—R. A. Oakley, J. E. W. Tracy.

Proposed expenditures, 1915–16.—$222,740.

Cotton Seed:

Object.—Purchasing, testing, packeting, franking, and mailing cotton seed for congressional distribution.

Procedure.—The varieties of cotton to be distributed are selected by the Office of Acclimatization and Adaptation of Crop Plants and Cotton Breeding. and the fields from which the seed is obtained are inspected from time to time during the growing season by the experts of that office. A general distribution of a small quantity of seed, to enable the farmer to become acquainted with the characters of the variety, is to be followed in the most promising communities by a special distribution of a larger quantity, enough to produce at least one full bale of the new variety and also to furnish a supply of seed for planting the entire crop of the next season.

Location.—Washington, D. C.

Date begun.—1902.

Results.—Establishment of better grades of high-yielding strains of cotton in the South. Data in unnumbered B. P. I. Circular, "Distribution of Cotton Seed in 1914."

Assignment.—R. A. Oakley.

Proposed expenditures, 1915–16.—$7,500.

Tobacco Seed:

Object.—Purchasing, testing, packeting, franking, and mailing tobacco seed for congressional distribution.

Procedure.—The varieties of tobacco to be included in the distribution are selected by the Office of Tobacco Investigations, and the fields from which the seed is obtained are inspected from time to time by the experts of that office. Plants true to type and of the highest grade are selected and bagged, and seed thus obtained is used in the distribution.

Location,—Washington, D. C.

Date begun.—1902.

Results.—Introduction of improved strains of tobacco.

Assignment.—R. A. Oakley.

Proposed expenditures, 1915–16.—$800.

Lawn-Grass Seed:

Object.—Purchasing, testing, packeting, assembling, and mailing lawn-grass seed for congressional distribution.

Procedure.—All seed is purchased on competitive bids and before acceptance is tested for purity and germination. For the South, Bermuda-grass seed is furnished for lawn making, while for the other sections of the country a mixture of Kentucky bluegrass, redtop, perennial rye-rass, and white clover is supplied. A circular giving full directions for making and maintaining a lawn accompanies each package of seed.

Location.—Washington, D. C.

Lawn-Grass Seed—Continued.
Date begun.—1902.
Results.—Establishment of better lawns throughout the United States.
Assignment.—R. A. Oakley.
Proposed expenditures, 1915–16.—$1,500.

Strawberry Plants:
Object.—Congressional distribution of strawberry plants.
Procedure.—Quotations are obtained from a number of the principal growers, and orders are placed during May for the delivery of the required number of plants during the latter part of November.
Location.—Washington, D. C.
Date begun.—1902.
Results.—Encouragement of the growing of strawberries in the home garden.
Assignment.—R. A. Oakley.
Proposed expenditures, 1915–16.—$1,500.

Dutch Bulbs:
Object.—Congressional distribution of Dutch bulbs.
Procedure.—Standard varieties of tulips and narcissus are purchased on competitive bids, principally from firms in Holland, and distributed on congressional requests.
Location.—Washington, D. C.
Date begun.—1902.
Results.—Encouragement of the growing of Dutch bulbs.
Assignment.—R. A. Oakley.
Proposed expenditures, 1915–16.—$2,500.

Miscellaneous Seeds and Plants:
Object.—Congressional distribution of miscellaneous seeds and plants.
Procedure.—Miscellaneous seeds and rose bushes, ornamental shrubs, and other plants are purchased on competitive bids and distributed on congressional requests.
Location.—Washington, D. C.
Date begun.—1902.
Results.—Encouragement of the growing of ornamentals about the home.
Assignment.—R. A. Oakley.
Proposed expenditures, 1915–16.—$4,000.

Seed Cleaning:
Object.—To remove impurities from seeds purchased for congressional distribution and to test seed-cleaning devices.
Procedure.—Improved modern seed-cleaning machines have been procured, together with a full equipment of screens. All vegetable, flower, and field seeds containing impurities are thoroughly cleaned before distribution. Experiments are being conducted in cleaning drug-plant, sugar-beet, and other seeds.
Cooperation.—Drug-Inspection Laboratory, Bureau of Chemistry.
Location.—Washington, D. C.
Date begun.—1906.
Results.—Large quantities of field seeds were cleaned; also considerable quantities of radish and other vegetable seeds. Successful methods have been developed for cleaning senna, celery, and sugar-beet seed.
Assignment.—R. A. Oakley.
Proposed expenditures, 1915–16.—$1,000.

Total, Congressional Distribution, $292,800.

PURCHASE AND DISTRIBUTION OF NEW AND RARE SEEDS.

Purchase and Distribution of New and Rare Seeds:
Object.—To disseminate new and rare high-grade seed of crops new to sections where the data of the department indicate such crops to be of considerable promise. Each package contains a sufficient quantity for a preliminary trial, and, where it is at all practicable, the recipient is urged to use the seed for the production of stocks for future plantings. It is believed that if this practice is followed consistently it will result in a material improvement of the crops of the country.

Purchase and Distribution of New and Rare Seeds—Continued.

Procedure.—A list of new and rare seeds worthy of special distribution is prepared by the specialists of the bureau. The sources from which such seeds are obtainable and the quantity available for fall delivery are ascertained in advance. Senators and Representatives are advised of the kinds of seed available and suitable for distribution in their respective districts and are asked to submit a list of names of a number of reputable farmers in their districts who would be willing to plant and care for an area large enough to determine the cost of cultivating and harvesting the new crop in their section in conformity with plans outlined by the department. When the reports are received at the close of the season they are referred to the respective offices dealing with the particular crops involved for their information and for such follow-up work as they may deem advisable. The officer in charge of the distribution of new and rare seeds is responsible for the finances and has charge of all matters involved in the purchase, propagation, testing, and distribution of these new and rare seeds, but always in cooperation with and through the advice of crop specialists of the office interested in the particular crops involved. Each office of the bureau to which any crops included in the distribution belong prepares the necessary cultural directions and report blanks, indicates the quantity of seeds to be included in the package, and takes charge of such reports as may be received from growers.

Location.—Headquarters, Washington, D. C.; distribution throughout the United States.

Date begun.—1914.

Results.—During the fiscal year 1914, 285,000 packages of seed were distributed, including 180,000 packages of seed of new and rare forage crops and 105,000 packages of seed of new and improved varieties of cotton. Each package contained a sufficient quantity for a preliminary trial, and the recipient was urged to use the seed for the production of stocks for future plantings. Inclosed in each package of seed was a circular giving full directions for the planting and cultivation of the crop and a report card to be filled out by the recipient and submitted to the department. Seed of the following crops was included in the distribution: Sudan grass; feterita; Freed sorghum; dwarf Hegari sorghum; Grimm, Canadian Variegated, and Kansas alfalfas; Brabham, Groit, Early Buff, and Buff Catjang varieties of cowpeas; Haberlandt, Tokio, Mammoth Yellow, Chiquita, Morse, Black Eyebrow, and Manchu varieties of soy beans; Kaiser, Bangalia, and Golden Vine field peas; adzuki beans; sumac sorghum; Kursk millet; dwarf milo; Natal grass; Rhodes grass; Chinese, Lyon, 100-Day Speckled, and Florida velvet beans; a grass mixture for meadow and pasture; crimson clover; hairy vetch; crown vetch; bur clover; crimson clover; St. John's rye; and the Columbia, Dixie, Durango, Lone Star, Trice, and Holdon varieties of cotton.

Assignment.—R. A. Oakley.

Proposed expenditures, 1915–16.—$44,530.

Total, Seed Distribution, $337,330.

[Extension.]

DEMONSTRATIONS ON RECLAMATION PROJECTS.

Supervision:

Object.—To supervise agricultural demonstration work on Government reclamation projects and to conduct office business in connection therewith.

Location.—Washington, D. C.

Date begun.—1914.

Assignment.—F. D. Farrell.

Proposed expenditures, 1915–16.—$7,000.

Field Demonstrations:

Object.—To encourage and aid the settlers on the reclamation projects in the development of local agricultural industries by supplying information, making suggestions, and conducting demonstrations relating to agricultural industries and farm practices, and by assisting in the forma-

Field Demonstrations—Continued.

tion and conduct of farmers' cooperative organizations, for the purpose of improving the methods of production and disposal, methods of securing the financial assistance necessary, and bettering agricultural conditions generally. (See also Bureau of Animal Industry project in reference to this work.)

Procedure.—Field representatives, under the supervision of the Washington office, stationed on the reclamation projects, operate in direct cooperation with the settlers in furtherance of the objects outlined above.

Cooperation.—Bureau of Animal Industry, Reclamation Service, individual farmers, and various farmers' organizations.

Location.—California (Yuma project), Idaho (Boise and Minidoka projects), Montana (Huntley project), Nebraska-Wyoming (North Platte project), Nevada (Truckee-Carson project), Washington (Tieton project.), and Wyoming (Shoshone project).

Date begun.—1914.

Results.—The year has been devoted to the organization of agencies for the promotion of agricultural industries on the reclamation projects. This has been carried on by the employment of an agent on each of seven projects. Each of these agents has devoted his time to the promotion of some particular industry or small group of industries by encouraging the farmers to organize into associations and giving them advice in regard to the problems which the farmers meet in connection with these industries. Work on the Boise, Minidoka, and Tieton projects is devoted to demonstrations in dairying and other live-stock industries; on the Huntley and Truckee-Carson projects, to dairying and swine production; on the North Platte project, to hog production; and on the Shoshone project, to dairying and swine production. On most of the projects the work has not been under way long enough to show any definite results. On the North Platte project, where work was begun July 1, 1914, considerable progress has been made in the control of hog cholera. Hog raising is becoming one of the principal industries of the project, and during the year the number of swine increased from 14,000 to 22,000, and from July 1 to December 31, 1914, 135½ carloads of hogs were marketed. On the Truckee-Carson project, where work was begun in September, 1914, good progress has been made in establishing the dairy industry on a substantial basis, and the swine industry is gradually attracting more attention. Cooperative demonstrations have been arranged with a number of farmers with a view to determining the best methods of producing crops to supplement alfalfa in the feeding of hogs and dairy cattle.

Assignment.—F. D. Farrell, in charge; Boise project, H. A. Ireland; Huntley project, Carl Christopher; Minidoka project, E. F. Rinehart; North Platte project, Charles S. Jones; Shoshone project, Don G. Magruder; Tieton project, R. P. Bean; Truckee-Carson project, L. E. Cline.

Proposed expenditures, 1915–16.—$33,000.

Total, Demonstrations on Reclamation Projects, $40,000.

FOREST SERVICE.

GENERAL ADMINISTRATION.

Offices of the Forester and District Foresters:

Object.—Direction and control of all administrative and research activities of the Forest Service.

Procedure.—The administrative work of the Forest Service comprises (1) administration of the national forests, (2) purchase of lands on the watersheds of navigable streams, (3) protection of forested watersheds of navigable streams, in cooperation with States, and (4) application of forestry to private timberlands. The research work comprises studies in dendrology, forestry, the utilization of forest products, and the most effective use and improvement of grazing lands. Preference is given to problems arising in the administration of the national forests; but the investigations also include the forest and allied interests of the country at large. The administrative work is conducted through five branches at Washington, of Operation, Lands, Silviculture, Grazing, and Acquisition, respectively, each in charge of an assistant forester, and the office of the chief engineer. A sixth branch similarly directs the greater part of the research work. The field execution of both administrative and research work within their respective territories is directed by seven district foresters, each of whose offices includes a staff of experts corresponding to the branch chiefs at Washington.

Each national forest is administered by a supervisor with a corps of forest rangers and guards. The supervisors in charge of the 155 national forests and the directors of the 8 field experiment stations report directly to the district foresters. The Forest-Products Laboratory at Madison, Wis., reports directly to the chief of the branch of research at Washington. The bulk of national-forest business is transacted in the supervisors' and district offices, but transactions of large importance and matters of policy are passed upon by the Forester. General control and uniformity in the application of policies are maintained through field inspection by the Forester and his staff of assistant foresters and forest inspectors.

Location.—Washington, D. C. (Forester and district forester in charge of District 7); and district offices at Missoula, Mont., Denver, Colo., Albuquerque, N. Mex., Ogden, Utah, San Francisco, Cal., and Portland, Oreg.

Date begun.—Division of Forestry organized as an administrative unit in 1881.

Assignment.—H. S. Graves, A. F. Potter, F. A. Silcox, Smith Riley, A. C. Ringland, L. F. Kneipp, Coert Dubois, George H. Cecil, William L. Hall.

Proposed expenditures, 1915–16.—$69,946.

Law Work:

Object.—Performance of all legal work on behalf of the Forest Service.

Procedure.—The Solicitor of the Department of Agriculture assigns from his office to each Forest Service district an assistant who becomes a member of the executive force of the district, gives advice on legal matters to the district forester and his assistants, prepares contracts, leases, and other legal papers, and, subject to approval by the Solicitor, renders decisions on legal questions and institutes suits for trespass and other violations of national forest laws.

Cooperation.—Department of Justice.

Location.—Washington, D. C., and district headquarters.

Date begun.—1903; transferred to Solicitor's office in 1910.

Assignment.—R. W. Williams.

Proposed expenditures, 1915–16.—$21,390, including $5.200 allotted to the Office of the Secretary (Forest Appeals).

Accounts:

Object.—To receive and disburse the money and keep the financial and appointment records of the Forest Service.

Procedure.—The fiscal agent at Washington has general charge of all fiscal matters pertaining to the Forest Service and also immediate charge of accounts work in District 7. The district fiscal agents receive and disburse money, keep financial and appointment records, and supervise the accounting work on the national forests in their respective districts. Periodical reports are made to Washington and the quarterly accounts with the Treasury Department are transmitted through the fiscal agent at Washington. General accounts are kept by the fiscal agent in Washington, while the details of receipts and expenditures are kept by the district fiscal agents, who in turn rely upon the national-forest supervisors for more itemized detail with regard to costs, etc.

Location.—Washington, D. C., and district headquarters.

Date begun.—1905; present organization established in 1908.

Assignment.—M. E. Fagan.

Proposed expenditures, 1915–16.—$87,145.

Editorial Work:

Object.—Supervision and conduct of activities for diffusing a general knowledge of the principles and practice of forestry; preparation of Forest Service manuscripts for publication; proof reading; handling of requests for publications and of job printing; and development, custody, and use of exhibit material and lantern slides.

Procedure.—Diffusion of information of educational value through exhibits, addresses, the press, and cooperation with educators, schools, and institutions; technical and literary review of manuscripts for publication.

Cooperation.—Exposition authorities desiring the use of exhibit material without cost to the Government; teachers and others desiring the use of lecture materials or sets of photographs for purposes of public instruction.

Location.—Washington, D. C.

Date begun.—1905.

Results.—In 1914 this office prepared for official publication 37 manuscripts; cared for all printing matters; distributed information; made 194 loans of lantern slides, 8 loans of exhibit material, and 84 loans of sets of photographs to school and library authorities; colored 831 lantern slides, 59 bromides, and 81 transparencies; and made 40 botanical drawings.

Assignment.—H. A. Smith.

Proposed expenditures, 1915–16.—$36,980.

Supply Depot and Property Audit:

Object.—To furnish necessary instruments, equipment, and supplies and to keep proper record of same.

Procedure.—The property clerk purchases all necessary supplies, instruments, and equipment, and issues them to the various forest offices upon requisition. The property auditor keeps a complete record of the value, location, condition, and disposal of all property purchased and owned by the Forest Service.

Location.—Ogden, Utah.

Date begun.—1907.

Assignment.—A. M. Smith, J. G. Falck.

Proposed expenditures, 1915–16.—$126,280.

Total, General Administration, $341,741 (research, $23,800).

PROTECTION AND ADMINISTRATION OF THE NATIONAL FORESTS.

OPERATION.

Supervision:

Object.—To administer and supervise the business organization of the Forest Service and fire protection of the national forests. In the fiscal year 1915 there were 162 national forests, with an area of approximately 186,000,000 acres. The forest force provided by law consists of

Supervision—Continued.

149 supervisors, 81 deputy supervisors, 392 rangers, 650 yearlong assistant forest rangers, and 80 assistant forest rangers for periods not exceeding six months.

Procedure.—The assistant forester in Washington and the assistant district foresters in charge of operation in the seven administrative districts, under the direction of the Forester and district foresters, respectively, supervise the organization and the business operation of the work on the national forests, including such items as personnel, quarters, maintenance, equipment, supplies, and forage, and also the activities of the protective force. The national forests are divided into districts, each with a ranger in charge, and during the season of fire danger additional assistants are provided. On each ranger's district a fire-detection system is maintained by patrol and lookouts. Upon discovery of a fire, the ranger and his assistants combat it until extinguished, organizing and supervising crews of temporary fire fighters when necessary.

Cooperation.—Forest users, railroad companies, owners of timberland, and State organizations.

Location.—Washington, D. C.; district and national forest headquarters; and national forests.

Date begun.—Administration of the national forests was provided for by act of Congress in 1897. The first express appropriation for the protection of the public timberlands was passed in 1872.

Assignment.—James B. Adams.

Proposed expenditures, 1915–16.—$2,653,929.

Geography:

Object.—Preparation of forest maps and photographs, compilation of forest statistics, and determination of the legal status of lands within the national forests.

Procedure.—Topographic and outline maps for use in the administration of the national forests are prepared from field sheets or notes, and the lithographing of the maps is performed in the Geological Survey plant. Negatives taken in the field by forest officers are developed and photo prints made therefrom upon requisition and approval by the proper officials. Statistics of various administrative transactions are annually called for from each forest for compilation and preservation in permanent volumes of the forest atlas. The work on the status of lands involves the examination and copying of records of the General Land Office, in addition to the assembling and verification of data submitted by field or district officers.

Cooperation.—Geological Survey, General Land Office, Coast and Geodetic Survey, and Census Bureau.

Location.—Washington, D. C., and district headquarters.

Date begun.—1907.

Results.—The Office of Geography includes the Sections of Atlas, Drafting, Photography, and Status. During the fiscal year 1914 the principal work accomplished was as follows: Cooperation in the preparation of lithographic plates and the printing of 119,615 copies of forest maps; compilation of the statistical volume of the forest atlas; forest and title classification and silvicultural maps, 890; topographic and outline maps, 964; miscellaneous drawings, 436; negatives developed, 5,620; photo prints made, 50,239; bromide enlargements and transparencies, 666; lantern slides, 1,340. The section of Status made reports on the titles and areas of lands covering 25,335 sections; 2,836 sheets of field notes of surveys, and 6,144 additional reports upon land titles to district foresters.

Assignment.—Chas. A. Kolb.

Proposed expenditures, 1915–16.—$123,370.

Improvements:

Object.—Construction and repair of roads, trails, telephone lines, firebreaks, fences, corrals, buildings, bridges, water improvements, etc.

Procedure.—Forest supervisors recommend improvement projects regarded as necessary for national-forest administration, and after approval by the district forester the work is performed under the immediate supervision of the supervisor and the local ranger force and such specialized assistants as can be furnished from the district forester's office.

Improvements—Continued.

Cooperation.—States, counties, telephone companies, and other organizations in the construction and maintenance of roads, trails, telephone lines, etc.

Location.—National forests.

Date begun.—1907.

Results.—The estimated value of permanent improvements on the national forests at the close of the fiscal year 1914 was $4,400,000.

Assignment.—O. C. Merrill.

Proposed expenditures, 1915–16.—$729,017.

Total, Operation, $3,506,316.

SILVICULTURE.

Supervision:

Object.—Administration of timber sales, timber reconnoissance, timber and fire trespass, reforestation, administrative use, free use, and insect control; also review and approval of working plans for the better administration of the forests and the conduct of the cooperative projects with Eastern States and timberland owners.

Location.—Washington, D. C., and district offices.

Date begun.—1907.

Assignment.—W. B. Greeley.

Proposed expenditures, 1915–16.—$74,620.

Timber Sales:

Object.—Sale of timber on the national forests.

Procedure.—Timber sales are made in accordance with the acts of June 4, 1897, and of August 10, 1912, the former providing for commercial sales and the latter for sales at cost to homestead settlers and farmers. Commercial sales are made at the appraised value of the timber and those in amounts over $100 in value must be advertised for competitive bids. Sales at cost are not advertised. Authority is delegated to the district foresters, forest supervisors, and forest rangers to conduct negotiations and consummate sales within prescribed amounts. Larger sales are made by the Forester.

Cooperation.—Advice rendered upon request to States and homesteaders for disposal of timber contiguous to national-forest timber proposed for sale.

Location.—Washington, D. C.; district offices; and national forests.

Date begun.—1899.

Results.—In 1914 contracts were entered into for the sale of over 1,500,000,000 feet of national-forest timber, valued at more than $3,500,000. In addition to the timber sold, there were tracts aggregating nearly 3,000,000,000 feet appraised and approved for advertisement and sale.

Assignment.—W. B. Greeley, R. Y. Stuart.

Proposed expenditures, 1915–16.—$279,339.

Timber Reconnoissance:

Object.—To determine national-forest timber resources, particularly available timber supplies.

Procedure.—Under organized crews estimates of the standing timber are made, silvical and logging data essential to timber sales secured, and topographic and cultural data obtained for base maps of the area.

Location.—Washington, D. C.; district offices; and national forests.

Date begun.—1905.

Results.—During the fiscal year 1914 estimates, surveys, maps, and detailed data on the character and condition of the timber and methods of exploitation were obtained for 2,433,598 acres of national-forest land.

Assignment.—W. B. Greeley, R. Y. Stuart.

Proposed expenditures, 1915–16.—$232,105.

Timber Trespass:

Object.—To prevent the unlawful cutting of national-forest timber and to recover damages sustained from timber trespass.

Procedure.—Upon the detection of timber trespass, an examination of the area is made to determine the damages sustained and to ascertain the conditions under which the cutting occurred. The trespass report is submitted to the appropriate forest officer for review and action. District foresters are authorized to settle innocent timber trespasses; also

Timber Trespass—Continued.

willful timber trespasses, in which legal proceedings are unnecessary, if the estimated damages do not exceed $500. The Forester settles all similar cases exceeding $500 and not more than $5,000. Settlement of cases with damages exceeding $5,000 is effected by the Secretary of Agriculture. All cases requiring the institution of legal proceedings are reported, through the Forester, to the Secretary of Agriculture for reference to the Attorney General.

Cooperation.—Department of the Interior in cases initiated by that department prior to the creation of the forest.

Location.—Washington, D. C.; district offices; and national forests.

Date begun.—The first express appropriation for the prevention of depredations on public timberlands was passed in 1872.

Results.—Timber trespass on the national forests continues to diminish in extent. At the end of the fiscal year 1914 there were 56 pending cases.

Assignment.—W. B. Greeley, R. Y. Stuart.

Proposed expenditures, 1915–16.—$7,862.

Fire Trespass:

Object.—To prevent the destruction of national-forest timber from fires attributable to negligence or malice, and to recover damages sustained from fire trespass.

Procedure.—Same as preceding project.

Location.—Washington, D. C.; district offices; and national forests.

Date begun.—1872.

Results.—At the end of the fiscal year 1914 there were 26 fire-trespass cases pending, as against 27 pending at the close of 1913 and 42 at the close of 1912.

Assignment.—W. B. Greeley, R. Y. Stuart.

Proposed expenditures, 1915–16.—$6,189.

Free Use:

Object.—To grant free use of national-forest timber for domestic purposes to bona-fide settlers, miners, residents, and prospectors, and for public purposes to other branches of the Federal Government.

Procedure.—Upon application from persons entitled to the privilege, timber is granted free of charge for certain uses specified by law. The cutting and removal of the timber is required to be conducted in accordance with the terms of the permit and the regulations prescribed by the Secretary of Agriculture. Authority is delegated to the district forester, forest supervisor, and forest rangers to issue free-use permits within specified amounts. Permits in excess of the district forester's authorization are approved by the Forester.

Location.—Washington, D. C.; district officers; and national forests.

Date begun.—1897.

Results.—During the fiscal year 1914 39,466 free-use permits were issued, aggregating 120,575,000 board feet of timber, valued at $183,223.09.

Assignment.—W. B. Greeley, R. Y. Stuart.

Proposed expenditures, 1915–16.—$34,593.

Insect Control:

Object.—The protection of national forests against insect infestation.

Procedure.—The control of infestations and the elimination of infested trees are effected as far as practicable by timber sales, free use, and administrative use. When this is not practicable, control projects are organized and conducted by the Forest Service personnel as far as available funds permit.

Cooperation.—Bureau of Entomology, States, and private owners of timber contiguous to national forests.

Location.—Washington, D. C.; district offices; and national forests.

Date begun.—1901.

Results.—During the fiscal year 1914 the bulk of the control operations was confined to stamping out infestations which threatened the more accessible and valuable stands of timber on the Stanislaus, Sierra, Trinity, and Klamath National Forests in California, the Deerlodge and Flathead National Forests in Montana, and the Ochoco National Forest in Oregon.

Assignment.—W. B. Greeley, R. Y. Stuart.

Proposed expenditures, 1915–16.—$35,798.

Reforestation:

Object.—To reforest national-forest areas entirely denuded or scantily covered with forest growth; also to secure seed and to maintain nurseries for the production of planting stock.

Procedure.—The work is planned and conducted on the basis of restocking annually approximately 14,000 acres by planting and 2,500 acres by direct seeding. Permanent Forest Service nurseries produce the required amount of stock for planting. Native seed is collected from the national forests, and exotic seed, of which but a small supply is used for planting stock in the nurseries, is purchased.

Location.—Washington, D. C.; district offices; and national forests.

Date begun.—1901.

Results.—During the fiscal year 1914, 6,632.34 acres of national-forest land were sown to tree seed and 14,045.17 acres were planted.

Assignment.—W. B. Greeley, R. Y. Stuart.

Proposed expenditures, 1915–16.—$166,027.

Development of Private Forestry:

Object.—Development of such lines of improved management through suggestion, experiment, and demonstration as may be found practicable without attempting elaborated or comprehensive working plans.

Procedure.—This work consists of keeping in constant touch with timberland owners and operators in the more important regions, attending their meetings, cultivating their acquaintance, making arrangements for experiments and demonstrations when practicable, giving suggestions and advice on specific improvements in handling lands or conducting logging operations, and the like.

Location.—Washington, D. C.

Date begun.—1898.

Results.—Examination has been made of a number of tracts where forestry is now being practiced.

Assignment.—E. S. Bryant.

Proposed expenditures, 1915–16.—$3,200.

State Cooperation:

Object.—(1) To assist States in conserving their forest resources; (2) to compile State forestry laws; and (3) to cooperate in protection of forested watersheds of navigable streams from fire, under section 2 of the Weeks law (Mar. 1, 1911).

Procedure.—The foregoing objects are accomplished (1) by correspondence or field examinations and reports on special problems; (2) by arranging laws according to subjects which will show what the State has or has not done in forestry legislation and using the compilation chiefly in connection with correspondence; and (3) by an agreement with each State, under which Federal expenditures are incurred for the employment of forest-fire patrolmen, provided the State expends at least an equal amount for fire-protection purposes.

Cooperation.—In connection with (1), under "Object," State forestry departments, private forestry associations, and similar organizations; and (3) with States of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, New Jersey, Maryland, West Virginia, Kentucky, Michigan, Minnesota, South Dakota, Montana, Idaho, Washington, and Oregon.

Location.—Washington, D. C.

Date begun.—1898.

Results.—A large number of States have been encouraged to adopt sound forest policies through the passage of progressive legislation. The compilation of State forestry laws has produced very wide educational results in showing which States have adopted the most advanced and practical forestry laws. Approximately 13,000,000 acres of forest land have been protected from fire, and the people have been educated to the needs of fire protection.

Assignment.—J. G. Peters.

Proposed expenditures, 1915–16.—$103,200.

Total, Silviculture, $942,983.

GRAZING.

National-Forest Range Management:

Object.—Administration and general supervision of all matters pertaining to the grazing of live stock upon national forest ranges, including recommendations to the Secretary of Agriculture regarding the number and kind of stock to be grazed on each forest each year; the establishment of grazing periods and grazing fees for each kind of stock; division of the range between different kinds of live stock and the owners thereof; general supervision of stock grazed upon the forests; prevention of stock losses; enforcement of Federal and State quarantine regulations; protection of fish and game; development of forage resources; prevention of damage to forest growths and watersheds; determination of improved methods of handling live stock; range reconnoissance; extermination of predatory animals.

Procedure.—The Washington office, through the district forester located in each of the seven separate districts, directs the work of administration in handling the live stock under permit on the forests. It secures from the Secretary of Agriculture his approval of the number of stock which should be grazed upon the forest ranges and designates the yearlong charge for each class of stock. The district foresters distribute the stock and establish fees for shorter periods than the yearlong. All trespass cases in which civil or criminal suits should be instituted for grazing stock upon national-forest lands without permit or in violation of any of the grazing regulations are forwarded from each district to be handled by the Washington office, and, if approved, are forwarded to the Solicitor of the department with proper recommendations. In all cooperation between the Forest Service and other bureaus of either the Department of Agriculture or other departments, the correspondence comes from the district foresters to the Forester and is taken up by the Forester with the proper bureau. Requisitions from the district foresters for supplies of fish for stocking streams on national forests, requests from permittees for vaccine for prevention of blackleg in cattle, cooperation in the destruction of predatory animals, advice as to poisonous plants, and the identification of all forage plants are sent direct to the Forester, and in turn forwarded to the proper bureau with such recommendations as may seem best. Appeals by permittees from the decision of the supervisors and district foresters are also decided by the Forester. Members of the office make field and office inspections during the year in order to correct errors in the management of the forests or handling of the routine correspondence or files in the supervisors' offices. An extensive herbarium is maintained in Washington, which includes over 3,500 separate specimens gathered by forest officers in the field.

Cooperation.—Bureaus of Plant Industry, Animal Industry, and Biological Survey; Bureau of Fisheries; State live-stock officers; State fish and game wardens; over 125 officially recognized organizations of stock growers using national forests.

Location.—Washington, D. C., and district and national forest headquarters in 25 different States and Territories.

Date begun.—1905.

Results.—Receipts from grazing fees approximate $1,000,000 per year. Average volume of permit business transacted: Paid permits, 29,000, involving approximately 1,600,000 cattle, horses, and swine, and almost 8,000,000 sheep and goats, exclusive of natural increase and stock exempt from permit; free-crossing permits, 2,400, authorizing the passage of about 60,000 cattle and horses and 4,000,000 sheep and goats; free permits on account of private land, 1,500, involving over 69,000 cattle and horses and 400,000 sheep and goats. Range conditions are from 25 to 100 per cent better than when national forests were created. Ranges have been equitably apportioned between qualified applicants. Orderly and systematic handling of the range has prevented overgrazing and improper use, lessened erosion, increased the forage productivity of denuded areas, eliminated friction between stock growers, checked the spread of stock disease, and protected each permittee in the use of his allotted range. The ravages of predatory animals have been reduced. Areas containing poisonous plants have been located and marked. All Federal and State quarantine regulations have been enforced. The range investigative work

National-Forest Range Management—Continued.

has resulted in the introduction of improved methods of handling stock, the utilization of previously unused ranges, and the general development of the forage resources.

Assignment.—A. F. Potter, Will C. Barnes, J. W. Nelson.

Proposed expenditures, 1915–16.—$279,579.

LANDS.

Supervision:

Object.—General supervision of all matters relating to the application of public-land laws to land within national forests and the uses of national-forest lands for purposes other than timber sales and grazing. This branch includes activities relating to boundary examinations, claims, administrative sites, settlement; leases under the act of February 28, 1899, of land near mineral springs; leases of other lands under the act of March 4, 1915; special uses and rights of way, occupancy trespass, land classification, land exchange, and entry surveys.

Cooperation.—General Land Office, Geological Survey, Reclamation Service, and the Office of Indian Affairs.

Location.—Washington, D. C., and district headquarters.

Date begun.—1907.

Assignment.—E. A. Sherman.

Proposed expenditures, 1915–16.—$53,355.

Boundary Examination:

Object.—Revision and correction of forest boundaries.

Procedure.—Areas of doubtful or uncertain value for forest purposes or possible value for agriculture lying near the exterior boundaries of the forests are inspected by special land examiners assigned either from the forest force, the district office, or the Washington office, according to the difficulties of the case. The map and reports resulting from this inspection are considered and approved by the local forest supervisor and transmitted to the district forester with appropriate recommendations. They are there further scrutinized and forwarded to the Forester with recommendations. Here the status records are verified and, if the Forester approves elimination, the matter is submitted to the Secretary for final consideration. The proclamation diagrams are prepared by the Forest Service. The proclamation or Executive order is signed by the President.

Cooperation.—Department of the Interior.

Location.—Washington, D. C.; district headquarters; and national forests.

Date begun.—1897.

Results.—In the main, the boundaries of the national forests may be said to be reasonably permanent. The lines have been carefully drawn to include, so far as practicable, only those lands which upon examination have been found to be valuable for timber or watershed protection purposes. Boundary changes which may be made in the future will be based on the results secured through the classification of the forests and a study of the economic conditions surrounding each. Usually the changes will involve only comparatively small areas, generally resulting in the exclusion of limited tracts having either very low value for forest purposes or some real value for agriculture.

Assignment.—B. L. Wheeler.

Proposed expenditures, 1915–16.—$51,153.

Claims:

Object.—The investigation of all matters relating to the acquisition of title under the public land laws to lands within national forests.

Procedure.—Upon receipt by a forest supervisor of a notice from the local land office of intention of a claimant to ask for patent, or when a claim is being asserted without complying with the requirements of the law and in such a manner as to interfere with national-forest administration, a report of all material facts is prepared by a qualified examiner and forwarded by the supervisor to the district forester. The report, with appropriate recommendations, is submitted by the district forester to the Chief of Field Division, General Land Office, for appropriate action. When hearings are ordered by the Commissioner of the General Land Office,

Claims—Continued.

forest officers appear thereat and testify as to the facts of which they have knowledge.

Cooperation.—General Land Office; Office of the Solicitor, Department of Agriculture.

Location.—Washington, D. C.; district headquarters; and national forests.

Date begun.—1897.

Results.—During 1914, 1,321 individual tracts of land in the national forests passed into private ownership through the patenting of claims, and 287 entries of all descriptions were canceled.

Assignment.—Charles H. Squire.

Proposed expenditures, 1915–16.—$53,810.

Administrative Sites:

Object.—Selection of areas within or near national forests for use as administrative quarters for forest officers and temporary employees. Areas within national forests are also posted for utilization sites, such as logging camps, mill sites, banking grounds, nursery sites, and similar uses.

Procedure.—Areas within national forests which are needed or shortly will be needed for administrative purposes are selected by forest officers, the boundaries marked, and the location posted, and when funds are available improvements are constructed thereon commensurate with their uses. Records of the boundaries of such tracts are filed in the district offices. Areas near or adjacent to national forests on unappropriated public domain, which are desired for administrative uses, are withdrawn by presidential proclamation under the act of June 25, 1910, and thereafter posted and improved the same as those within. Administrative sites no longer needed are released and then revert to their former status.

Cooperation.—Executive Department and General Land Office.

Location.—Washington office, district offices, and national forests and adjacent lands.

Date begun.—1906.

Results.—New sites have been withdrawn and posted, former established sites examined, and such as were no longer needed released in whole or in part.

Assignment.—F. L. Harvey.

Proposed expenditures, 1915–16.—$9,434.

Settlement:

Object.—To examine and list for entry lands chiefly valuable for agriculture and not needed for public purposes, upon application or otherwise, and to assist bona fide applicants in securing title to such homestead lands within national forests under the act of June 11, 1906.

Procedure.—Application on regular blank forms furnished by the Forest Service is made out by the applicant and certified to before a forest officer, unless the securing of such certification will entail unnecessary hardship. The application is then forwarded to the district forester, from whence, if the tract has not been previously classified, it is sent for examination in the field and report thereon. If the land has been previously classified, the application is returned and the applicant advised of the previous action taken. The applicant is accorded an opportunity to accompany the examiner when the examination is made, if he so desires. Upon the completion of the report, it is submitted to the district forester and, if approved by him, a list letter is prepared for the signature of the Secretary of Agriculture and forwarded to the Forester. If not approved, the applicant is so notified, the reasons for the rejection of the application being stated. Upon receipt of the listing letter by the Forester, if found regular, it is forwarded to the Secretary of Agriculture for signature and submission to the Secretary of the Interior, by whom the area is restored to entry under the act of June 11, 1906. An appeal may be made to the Forester and Secretary of Agriculture from the rejection of the application by the district forester if filed within 30 days from receipt of such rejection letter.

Cooperation.—General Land Office.

Location.—Washington, D. C.; district headquarters; and national forests.

Date begun.—1906.

Settlement—Continued.

Results.—Since the passage of the forest homestead act of June 11, 1906, there have been listed for entry 15,521 individual tracts, with an area of over 1,684,000 acres.

Assignment.—F. L. Harvey.

Proposed expenditures, 1915–16.—$115,381.

Special Uses and Rights of Way:

Object.—The authorization of use of national-forest lands whenever this can be done without interfering with the purposes for which the forests were established. Rights of way for railroads, irrigation works, telephone and telegraph lines, and public roads are permitted, as well as the use of lands for summer residences, hotels, resorts, and other like purposes. Special restrictions, in cooperation with interested municipalities, are placed on the use of lands in watersheds from which the municipalities obtain water for general municipal and domestic purposes. Indefinite permits are granted under the act of June 4, 1897, term permits under the act of March 4, 1915, and rights of way under various laws relating to the subject.

Procedure.—Rights of way amounting to easements are secured through filing maps in the proper local land offices in accordance with the requirements of the Department of the Interior. Maps are referred to the Forest Service for investigation of the proposed location of the right of way and the securing of stipulations for the protection of the forests. When the latter are obtained, a report prepared in the office of the district forester is submitted to the Secretary of the Interior through the office of the Secretary of Agriculture. Other special-use permits are obtained on application to the forest supervisors. Reports on applications are made by the forest rangers and the permits in general are granted by the supervisors. In cases where the permits are granted by the district forester or the Forester, the forest supervisor submits a report on which the action is based.

Cooperation.—As to rights of way, General Land Office; as to certain watersheds, the municipalities interested therein.

Location.—Washington, D. C.; district headquarters; and national forests.

Date begun.—1898.

Results.—At the close of 1914 there were 17,048 permits in effect authorizing the occupancy of small areas for miscellaneous uses. Ninety-six rights of way amounting to easements were granted during the year.

Assignment.—Charles H. Squire.

Proposed expenditures, 1915–16.—$33,500.

Occupancy Trespass:

Object.—The prevention of illegal occupancy of national-forest lands.

Procedure.—The facts relating to an unpermitted occupancy of national-forest lands are obtained by the forest supervisor and submitted by him to the district forester. The latter, if unable to adjust the matter, forwards the report to the assistant to the Solicitor, who, if the facts warrant, recommends that the Department of Justice be asked to institute appropriate proceedings to protect the interests of the United States.

Cooperation.—Solicitor of the department.

Location.—District foresters' headquarters and national forests.

Date begun.—1897.

Results.—Cases of this character have almost entirely disappeared.

Assignment.—Charles H. Squire.

Proposed expenditures, 1915–16.—$1,572.

Entry Surveys:

Object.—The final survey for patent of homesteads on the national forests initiated under the forest-homestead act of June 11, 1906, and the act of March 3, 1899.

Procedure.—Upon request by the district forester the United States surveyor general issues to the Forest Service surveyor detailed special instructions for the entry survey of each homestead claim. After the survey is executed in the field the necessary plat and field notes are prepared and submitted to the surveyor general. When approved by him these returns are transmitted to the General Land Office in Wash-

Entry Surveys—Continued.

ington. If found correct, the survey is accepted by the Commissioner of the General Land Office and photographic copies of the plat (made by the Forest Service) are supplied to the homestead entryman and to the local land office for use in the submission of final proof upon the entry.

Cooperation.—General Land Office and United States surveyors general.

Location.—Washington, D. C., and district headquarters.

Date begun.—1913.

Results.—In the two years since this work was undertaken 1,200 homestead claims have been surveyed in the field. Five hundred of these surveys have been approved by the several United States surveyors general, and 200 of these have been finally accepted by the General Land Office. The remaining 300 are now awaiting acceptance by the General Land Office. Plats and field notes of the other 700 cases are either in course of preparation or else are pending before United States surveyors general.

Assignment.—R. V. R. Reynolds.

Proposed expenditures, 1915–16.—$86,455.

Land Classification:

Object.—The classification and segregation of lands within the national forests that may be opened to settlement and entry under the homestead laws applicable to the national forest or that should properly be eliminated therefrom; also the designation and segregation of all lands required permanently for national-forest purposes.

Procedure.—Thorough field examination forms the basis of the work. This includes the gathering of information relative to the topography, climate, accessibility of the land, character of the soil; amount, character, and value of the standing timber; value of the land for watershed protection, and the use which is being made of other similar land in the vicinity. Detailed maps are prepared, illustrative especially of the timber and soil conditions, and these maps, accompanied by typewritten reports, are submitted by the local forest supervisor to the district forester for review. After approval by the district forester, the reports and maps are acted upon by the Forester and then submitted to the Secretary of Agriculture for final action. Approval by the Secretary results in the official classification of the land involved.

Cooperation.—Bureau of Soils.

Location.—Washington, D. C., and district and national-forest headquarters.

Date begun.—1912.

Results.—To date 18,177,263 acres have been finally reported upon and classified. Lands found to be "chiefly valuable for agriculture" either have been listed, and thus made available for entry under the forest-homestead act of June 11, 1906, or have been eliminated from the national forests and restored to the public domain.

Assignment.—John D. Jones.

Proposed expenditure, 1915–16.—$119,222.

Land Exchange:

Object.—Consolidation of national-forest lands by exchange with States or persons owning land within national-forest boundaries, upon the basis of equal values and areas, to obtain economy and efficiency in administration and protection of the lands of each of the parties.

Procedure.—Under special acts of Congress, field examinations by appraisers are made of lands to be exchanged. Reports of examiners are submitted through the district forester's office to the Forester for approval of the Secretary of Agriculture. When approved the Secretary of the Interior is asked to accept reconveyances of private or State lands and issue patents to the Government lands agreed upon in exchange.

Cooperation.—Department of the Interior.

Location.—Washington, D. C.; district headquarters; and national forests.

Date begun.—1909.

Results.—With private owners, 3,841 acres have been exchanged and 25,428 acres are pending approval. With the State of South Dakota, 11,000 acres have been exchanged and conveyances involving 49,143 acres are pending in the Department of the Interior. There are also pending in the Department of the Interior 548,157 acres to be exchanged with Idaho. Work is also progressing on exchanges with the following States: Mon-

Land Exchange—Continued.
tana, 766,000 acres; Washington, 575,455 acres; Michigan, 16,000 acres; and Oregon, 25,989 acres.
Assignment.—E. A. Sherman.
Proposed expenditures, 1915–16.—$50,000.

Total, Lands, $573,882.

ENGINEERING.

Advice on Engineering Matters:
Object.—To give advice and make recommendations upon general engineering problems encountered in connection with work in the various branches of the Forest Service, such as trail, bridge, and telephone construction, methods of surveying, etc., and to determine water-power values in settlement and boundary cases.
Location.—Washington, D. C., and district headquarters.
Date begun.—1910.
Assignment.—O. C. Merrill, T. W. Norcross.
Proposed expenditures, 1915–16.—$2,200.

Water Power:
Object.—Investigations in connection with the development of the water resources of the national forests for water power, irrigation, and water-supply purposes; development of policy of water-power administration upon national forests; preparation and issuance of term permits for the occupancy of national-forest land for water-power plants and for transmission lines; examination and report to the Department of the Interior upon applications for easements for railroad and irrigation purposes within national forests.
Procedure.—Applications for permits for water-power purposes are filed with the district foresters, examined and reported upon by the district engineers, and referred to the chief engineer for review and approval. Applicants execute stipulations for the protection of Government property, for the payment of annual rentals for national-forest land occupied, for keeping certain records, for complying with State regulations of rates and service, and for submitting the property to State or municipal purchase under certain conditions. Permits for the occupancy of the land are issued by the Secretary. Applications for easements are filed with the General Land Office and submitted to the Forest Service for examination and report by the district engineers and the chief engineer. Final approval is by the Secretary of the Interior upon recommendation of the Secretary of Agriculture.
Cooperation.—Department of the Interior and certain States.
Location.—Washington, D. C., and district headquarters.
Date begun.—1905.
Results.—On July 1, 1914, 184 permits were in effect for water-power projects (including transmission lines) and 103 separate permits for transmission lines. The total power capacity of projects under permit was 1,067,621 horsepower, an increase of 284,021 horsepower, or 36 per cent for the fiscal year. The total number of approved easements now in force upon the national forests is approximately 800.
Assignment.—O. C. Merrill, T. W. Norcross.
Proposed expenditures, 1915–16.—$29,235.

Road Construction Under the 10 Per Cent Fund:
Object.—Construction and maintenance of roads, trails, and bridges within national forests for the purpose of opening new territory to settlement and of providing means of communication and transportation to settlers within or adjacent to the national forests.
Procedure.—General plans for road construction are prepared for each State to which the appropriation, consisting of 10 per cent of the net receipts from the national forests within such State, is applicable. Roads are constructed in the order of their importance as fast as funds are available.
Cooperation.—Office of Public Roads and Rural Engineering, county and other local governments, corporations, and individuals.
Location.—All national-forest States and Alaska.
Date begun.—1912.

Road Construction Under the 10 Per Cent Fund—Continued.

Results.—During the year about 450 miles of road and 20 miles of trail were built or repaired. Of this total, work on about 200 miles was in cooperation with local governments, and on 125 miles with corporations and individuals.

Assignment.—O. C. Merrill.

Proposed expenditures, 1915–16.—$10,000.

Total, Engineering, $41,435.

ACQUISITION OF LANDS UNDER THE WEEKS LAW.

Examination and Purchase:

Object.—To acquire lands for national-forest purposes on the headwaters of important navigable streams.

Procedure.—Twenty-one purchase areas, comprising 6,966,000 acres, have been designated within which the Forest Service invites proposals of land, examines and values tracts which are offered, and recommends purchases to the National Forest Reservation Commission, which approves and fixes the prices to be paid.

Cooperation.—Under the act of March 1, 1911, the Geological Survey is required to examine lands considered for purchase and to show whether they are influential in the protection of the navigability of navigable streams. After approval by the National Forest Reservation Commission the Office of the Solicitor conducts the title examinations and submits reports upon titles to the Attorney General, who must approve the titles to all lands before they can be acquired.

Location.—Lands are being acquired in the following purchase areas, with headquarters as stated:

PURCHASE AREAS.

State.	Name of area.	Headquarters.
New Hampshire	White Mountain	Gorham, N. H.
Georgia	Georgia	Blue Ridge, Ga.
	Savannah	Clayton, Ga.
North Carolina	Boone	Marion, N. C.
	Mount Mitchell	Do.
	Pisgah	Asheville, N. C.
	Savannah	Highlands, N. C.
	Nantahala	Andrews, N. C.
South Carolina	Savannah	Clayton, Ga.
Tennessee	Smoky Mountain	Townsend, Tenn.
	White Top	Abingdon, Va.
	Cherokee	Etowah, Tenn.
	Unaka	Johnson City, Tenn.
Virginia	Shenandoah	Harrisonburg, Va.
	Natural Bridge	Buena Vista, Va.
	Potomac	Woodstock, Va.
	Massanutten	Do.
	White Top	Abingdon, Va.
West Virginia	Potomac	Woodstock, Va.
	Shenandoah	Harrisonburg, Va.
	Monongahela	Elkins, W. Va.

Date begun.—1911.

Results.—To June 30, 1914, 1,104,529 acres had been approved for purchase, at an average price of $5.03 per acre, involving an expenditure of $5,560,202.21, of which 391,114 acres were acquired during the fiscal year 1914, at an average price of $4.96 per acre.

Probable date of completion.—About $400,000 of the original appropriation is available for further purchases, which will carry the work to approximately December 31, 1915. A further appropriation of $2,000,000 per year for five years has been recommended by the National Forest Reservation Commission.

Assignment.—William L. Hall.

Proposed expenditures, 1915–16.—$502,620 ($102,620 for examinations and surveys and $400,000 for purchase), not including $70,000 allotted to the Office of the Solicitor of the department and $1,600 to the Office of Accounts, Forest Service.

Total, Protection and Administration of the National Forests, $5,846,765.

[Research.]

FOREST INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—Administration of forest investigations, protection studies, and the silvicultural experiment stations, including investigations of wood, wood products, the Forest-Products Laboratory, the lumber industry and other wood-using industries, logging cost, mill and market studies, forest statistical investigations (including the collection of statistics of the wood-using industries), and general economic studies bearing on forestry and national-forest management.

Location.—Washington, D. C.; Madison, Wis.; district offices; and experiment stations.

Date begun.—Research was organized as a separate branch June 1, 1915.

Assignment.—E. H. Clapp.

Proposed expenditures, 1915–16.—$9,070.

SILVICULTURAL INVESTIGATIONS.

Dendrological Studies:

Object.—To secure information concerning the distinguishing geographical distribution of North American trees and shrubs.

Procedure.—New range data are secured through collections of local forest officers, examination of the various herbaria of the United States, and by the actual field work of the men directly charged with the dendrological studies.

Cooperation.—National Herbarium.

Location.—Washington, D. C.

Date begun.—1886.

Results.—During 1914, maps of botanical and commercial range were prepared for 36 pines, 17 ashes, and 40 other species; 700 new range points were added to the records; a bulletin on the cedars and junipers of the Rocky Mountains was completed and published; and an economic and taxonomic study of the shrubs of the genus Ceanothus has been continued during the year.

Assignment.—George B. Sudworth, W. H. Lamb, Georgia E. Wharton.

Proposed expenditures, 1915–16.—$8.450.

Forestation Studies:

(*a*) SEED STUDIES—

Object.—To determine the best methods of seed extraction, comparative germination of seed in greenhouse and field, seed production, and the effect of source of seed upon the resulting stock, for most of the important timber trees of the western national forests. Fifteen experiments are now under way.

Procedure.—Samples of seeds collected on the various national forests are tested in the greenhouses of the experiment stations to determine their germinability, and at several of the stations seed are also directly extracted from the cones, and the temperature most favorable for the rapid opening of the cones without injury to the viability of the seed is determined. Several phases of the study are now being completed in the districts, particularly with the lodgepole pine. Much of the work during the next year will be devoted to the study of the seed of western white pine.

Location.—Forest experiment stations and nurseries on the national forests.

Date begun.—1910.

Probable date of completion.—Most of the studies will be completed by 1918.

Assignment.—D. R. Brewster, C. G. Bates, G. A. Pearson, J. A. Mitchell.

Proposed expenditures, 1915–16.—$3,300.

(*b*) NURSERY PRACTICE—

Object.—To determine the best amount of seed to sow, time of sowing, depth of covering seed, methods of sowing, fertilizing, shading, watering, cultivation, root development, time and method of transplanting, and methods of retarding spring growth in nursery stock, with the principal

Forestation Studies—Continued.

timber trees of the western national forests. Twenty experiments are now under way.

Procedure.—Small experiments are conducted at the nurseries of the experiment stations as well as at the large administrative nurseries, which have been established primarily for the raising of stock for planting on the national forests.

Location.—All forest experiment stations and nurseries.

Date begun.—1910.

Probable date of completion.—1918.

Assignment.—D. R. Brewster, C. G. Bates, G. A. Pearson, S. E. Bower, J. A. Mitchell, E. N. Munns, J. F. Kümmel.

Proposed expenditures, 1915–16.—$6,000.

(*c*) SOWING AND PLANTING STUDIES—

Object.—To determine the best season and methods for sowing and planting in the field, the classes of stock to use, and the sites most suitable to the different species, for most of the important timber trees on the western national forests. Forty-eight studies are now under way.

Procedure.—Small sample plats are located at the experiment stations, and experiments are also conducted in connection with the large-scale reforestation operations of the national forests.

Location.—Forest experiment stations on the national forests and a number of forests where reforestation work is conducted.

Date begun.—1910.

Results.—The work has resulted in an improvement of the reforestation methods on the national forests. A manual on planting and sowing methods has been prepared.

Probable date of completion.—1920.

Assignment.—D. R. Brewster, C. G. Bates, G. A. Pearson, E. N. Munns, J. A. Mitchell, J. F. Kummel.

Proposed expenditures, 1915–16.—$4,051.

Studies of Forest Influences:

Object.—To determine the relation of forests to climate and stream flow, and also to obtain data necessary for a proper understanding of all silvicultural experiments in which the climatic factor enters into the results.

Procedure.—At the eight experiment stations, meteorological observations are being carried on in various forest types. The results of these observations are correlated with those on forest cover. At the Wagon Wheel Gap station the relation of forest cover to stream flow is given the main attention. The problem is studied on two adjacent watersheds, one of which is to be denuded and the other left under forest cover.

Cooperation.—Weather Bureau.

Location.—Forest experiment stations.

Date begun.—1910.

Results.—Nine experiments are under way.

Probable date of completion.—Most of the studies will be completed by 1920.

Assignment.—D. R. Brewster, C. G. Bates, J. A. Mitchell, E. N. Munns.

Proposed expenditures, 1915–16.—$5,812.

Forest-Management Studies:

Object.—To determine the best methods of cutting in different forest types in order to secure natural reproduction in the shortest possible time and to improve the quality and productivity of the stand.

Procedure.—In connection with the timber sales on the national forests sample plats are cut under different silvicultural methods, and the effect on the natural reproduction is being studied, also the effect of past cuttings on cut and burned-over land.

Location.—Forest experiment stations and national forests.

Date begun.—1912.

Results.—Forty experiments are now under way. These studies have resulted in the modification of our methods of cutting timber on the national forests, ensuring natural reproduction on the forest after it has been cut over.

Assignment.—R. Zon, D. R. Brewster, C. G. Bates, G. A. Pearson, J. A. Mitchell, J. V. Hofmann.

Proposed expenditures, 1915–16.—$21,657.

Volume, Growth, and Yield Studies:

Object.—To secure reliable data as to the volume, growth, and yield of the different species and types of forests as a basis for the proper handling of timber sales, management of the forests, and determining the damage caused by fire, trespass, etc. This information will also form the basis for the establishment of certain laws of tree growth.

Procedure.—Measurements of volume, growth, and yield are secured chiefly in connection with the timber sales on the national forests, as well as by periodic measurement of trees in permanent sample plats.

Location.—Washington, D. C.; forest experiment stations; and national forests.

Date begun.—This work dates from the beginning of the Division of Forestry (1886), but has received more impetus within the past four or five years.

Results.—For 98 species there have been prepared 1,520 tables on volume, growth, and yield. In addition there have been established over 300 permanent sample plats in all forest regions of the United States for the study of growth and yield of stands.

Assignment.—W. B. Barrows, A. O. Benson, C. G. Bates, T. T. Munger, W. D. Sterrett.

Proposed expenditures, 1915–16.—$4,462.

Protection Studies:

Object.—To ascertain the extent of the effect caused by fire, grazing, disease, insects, animals, and climatic agencies, such as snow, hail, and wind, upon standing timber and natural reproduction.

Procedure.—The work is done in cooperation with the Office of Forest Pathology of the Bureau of Plant Industry. The Office of Forest Pathology has now assigned forest pathologists to three national forest districts (districts 1, 3, and 5), in addition to one pathologist specializing in nursery diseases, who looks after the nurseries of all the districts. The forest pathologists are under the supervision of the Office of Forest Pathology, but work on problems which are most urgent in the management of the national forests.

Cooperation.—Bureaus of Plant Industry, Entomology, and Biological Survey.

Location.—Forest experiment stations and national forests.

Date begun.—1910.

Results.—Some modification in timber-sale practice has been effected which makes possible the utilization of diseased timber.

Assignment.—James R. Weir, Carl Hartley, W. H. Long, and E. P. Meinecke, Bureau of Plant Industry; A. J. Jaenicke, W. N. Sporhawk, and J. A. Mitchell, Forest Service.

Proposed expenditures, 1915–16.—$8,020.

Tree Studies:

Object.—To secure information concerning the important forest trees of this country as a basis for their proper management.

Procedure.—This information is collected largely in connection with the timber-sales work on the national forests, management studies, planting studies, studies of forest types, and similar studies. It is mainly a compilation of all the available information on the important timber trees of the United States.

Location.—Washington, D. C., and district headquarters.

Date begun.—1886.

Results.—Studies of seven species are now in progress.

Assignment.—Raphael Zon.

Proposed expenditures, 1915–16.—$4,185.

Wood-Lot Studies and Demonstrations:

Object.—To bring about better marketing of wood-lot products by wood-lot owners and also the better silvicultural handling of the wood lots.

Procedure.—After a study of existing conditions in a region or State, one or more men will be assigned to bring home to the wood-lot owners the points essential for them to keep in mind and the procedure to follow in order to accomplish their object. These Forest Service men will generally work in cooperation with the county agricultural agents of each State.

Wood-Lot Studies and Demonstrations—Continued.

They will give demonstrations in marketing wood-lot products and in silvicultural practice, and in a number of counties will prepare county working plans for the guidance of the county agents in giving advice to farmers.

Cooperation.—Through the States Relations Service with extension departments of State agricultural colleges wherever possible, boards of trade, farmers' unions, and any other organizations interested in the welfare of the farmer.

Location.—Headquarters at Washington, D. C. (See also "Results.")

Date begun.—1914.

Results.—Preliminary studies were made in Michigan, Wisconsin, Minnesota, Illinois, Indiana, Ohio, Kentucky, Tennessee, and Missouri during the summer of 1914. Three general bulletins on the wood-lot situation have been prepared but not yet issued: (1) "The Status and Value of Farm Wood Lots"; (2) "The Wood Lot: Estimating, Scaling, and Selling of Products"; and (3) "The Wood Lot: Its Care and Improvement." Bulletins dealing with the marketing of wood-lot products have been prepared for each of these States.

Assignment.—C. R. Tillotson, W. D. Sterrett, George N. Lamb, W. R. Mattoon, Benton MacKaye, E. H. Frothingham.

Proposed expenditures, 1915–16.—$10,500.

Farm Wood-Lot Management Survey:

Object.—To secure data over a wide range of the wood-lot section of the United States which will bring out the actual and relative importance of the farm wood lot in the general scheme of farm management.

Procedure.—Sixteen typical sections of the country will be visited, in each of which 50 to 75 farms will be inspected and certain data obtained which will bring out the foregoing points. It is estimated that it will take two years to complete this work, when a bulletin will be prepared reporting the results obtained.

Cooperation.—Office of Farm Management.

Location.—Headquarters at Washington, D. C.

Date begun.—1915.

Assignment.—E. R. Hodson, C. R. Tillotson, Benton MacKaye.

Proposed expenditures, 1915–16.—$2,400.

Forest Service Library:

Object.—Upkeep of Washington, district, supervisors', and forest experiment-station libraries. The total number of books and pamphlets on forestry at the Forest Service in Washington is 17,904; total number of volumes in the district and supervisors' offices, Forest-Products Laboratory, and experiment stations, 29,705.

Procedure.—Selecting books, with the assistance of the library committee, both for the Washington and field libraries; indexing all books received and all periodical articles of interest to the Forest Service; indexing all manuscript reports prepared in the service; preparing monthly bibliography of current literature, and special bibliographies on request; circulating books and periodicals throughout the Washington office; keeping a record of all books and periodicals furnished to field libraries.

Cooperation.—Main department library, Library of Congress, and other Government libraries.

Location.—Washington, D. C.; district headquarters; national forests; and forest experiment stations.

Date begun.—1899.

Assignment.—Raphael Zon, H. E. Stockbridge.

Proposed expenditures, 1915–16.—$3,800.

Computation:

Object.—Computation of field measurements for the entire Forest Service.

Procedure.—The data secured by the field force is worked up by the computing clerks in accordance with definite written instructions under the supervision of a technical forester.

Location.—Washington, D. C.

Date begun.—1901.

Computation—Continued.

Results.—During 1914, 12,000 forest measurements were worked up. These were elaborated into 37 volume, 8 yield, 21 growth, 18 form, 7 height and 7 miscellaneous tables; 867 copies of tables were distributed in answer to inquiries from lumbermen, timbeland owners, and foresters.

Assignment.—W. B. Barrows.

Proposed expenditures, 1915–16.—$10,220.

Total, Silvicultural Investigations, $92,857.

RANGE INVESTIGATIONS.

Supervision:

Object.—Office supervision; field inspection and supervision of all work connected with range investigations carried on by the Forest Service; and collection of data of a general character during the course of field inspection.

Cooperation.—Office of Economic and Systematic Botany, Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1907.

Assignment.—J. T. Jardine, A. E. Aldous.

Proposed expenditures, 1915–16.—$5,600.

Artificial Reseeding:

Object.—To determine (1) the lands where seeding to cultivated species of forage plants is economically possible from the range standpoint, as determined by altitude, exposure, soil, moisture, competition with native vegetation, and cost; (2) the species best adapted to any given set of conditions; (3) the best time to sow and the cultural methods which should be adopted; (4) the necessary protection against grazing; (5) the possibility of growing promising native species under cultivation and securing seed of such species for use in range reseeding.

Procedure.—Major investigations are conducted on small areas in a few localities by investigators especially qualified and equipped to make the careful study of all factors important in determining success or failure of a given species for range seeding. These intensive studies have been supplemented by over 500 seeding tests, which were outlined by the special investigators but carried out in large part by members of local forest forces. The object of the supplemental tests is to demonstrate principles developed by the intensive studies and to make the conclusions of the intensive studies more comprehensive by including a larger territory than is possible if the investigations in all cases involve a study in detail of the specific reasons for success or failure. The investigations during the coming year will be confined to thorough study on a small scale at experiment stations where men especially qualified for the intensive studies are located.

Cooperation.—Office of Economic and Systematic Botany, Bureau of Plant Industry, and S. T. Turney, Las Cruces, N. Mex.

Location.—Manti Forest, Utah; Conconino Forest, Ariz.; and Jornada Range Reserve, Dona Ana County, N. Mex.

Date begun.—1907.

Results.—Investigations prior to 1912 indicated that (1) seeding range lands to cultivated species is economically possible only on mountain meadows and other areas of minor extent having favorable soil and moisture conditions and below 500 feet of the true timber line; (2) late fall seeding and planting the seed by harrowing or trampling with sheep or by other means are advisable; (3) protection against grazing is essential the first year after seeding. The results on which these and other conclusions were based were published in Department Bulletin 4. The results of investigations since 1912 indicate that it will be difficult and, if finally feasible, will require considerable time to place promising native forage plants under cultivation in order to secure seed at a cost not prohibitive to distribution in reseeding depleted ranges where the present cultivated species will not make a successful growth.

Assignment.—A. W. Sampson, G. A. Pearson, C. E. Fleming.

Proposed expenditures, 1915–16.—$1,500.

Natural Reseeding:

Object.—To develop plans of range management which will secure natural reseeding of range lands with a minimum loss of forage through nonuse.

Procedure.—In studying this problem the first step is to determine for the principal range plants making up the forage crop the time growth begins and ends, the time of flowering, time of seed maturity, amount of seed produced, germination of seed, and other facts influencing the power of the plants to reproduce themselves naturally under range conditions. With these data available a comparative study is made of reproduction under total protection from grazing, grazing after seed maturity, and the existing grazing practice, with a view to working out a system of grazing which will allow the use of all forage each year and at the same time keep the forage plants vigorous and occasionally allow the production of a seed crop. The quadrat or plat method of study supplemented by general observations is followed, in order to ascertain any change in composition, density, or vigor of the vegetation. This method will be followed in the proposed studies with a view to working out efficient grazing practice for overgrazed lands at high altitudes in Utah forests, for the purpose of demonstrating the advantages of "deferred and rotation" grazing on the Eldorado and Medicine Bow Forests, and for the purpose of developing a plan of grazing for the dry ranges of the Southwest.

Cooperation.—Office of Economic and Systematic Botany, Bureau of Plant Industry, and Mr. S. T. Turney, Las Cruces, N. Mex.

Location.—Utah Experiment Station on the Manti National Forest, Utah; Eldorado National Forest, Cal.; Medicine Bow National Forest, Wyo.; Jornada Grazing Reserve, N. Mex.; and Santa Rita Grazing Reserve, Ariz.

Date begun.—1907.

Results.—As a result of the studies in natural reseeding, the system of "deferred and rotation" grazing now being put into application on national-forest ranges has been worked out. The principles upon which this system is based are fundamental, and it remains to adapt them to local conditions. The results in full were published in Department Bulletin 34 and in the Journal of Agricultural Research of November 16, 1914. Short articles have been published in outside journals.

Probable date of completion.—The experiments under way at present in Utah, California, and Wyoming will be completed probably in 1918. The proposed studies in the Southwest will necessarily continue not less than six years.

Assignment.—A. W. Sampson, F. D. Douthitt, L. H. Douglas, C. E. Fleming.

Proposed expenditures, 1915–16.—$3,243.

Distribution and Economic Importance of Herbaceous and Shrubby Plants on National Forest Ranges:

Object.—The collection and identification of herbaceous and shrubby plants on national-forest ranges and the accumulation of notes on distribution, growth requirements, forage value, and objectionable qualities to serve as a basis for (1) allotment of range to the class of stock for which it is best adapted, (2) proper adjustment of seasons of grazing, (3) determination of the carrying capacity of the range, (4) adjusting management to eliminate or decrease the loss of stock from stock-poisoning plants, (5) application of deferred and rotation grazing, and (6) general application of results from specific investigations. The most efficient management of range lands necessitates a thorough knowledge of the vegetation which makes up the forage crop.

Procedure.—All members of the grazing investigative force make collections of plants and observations relative to their life history, natural requirements, and forage value in connection with the work of other projects. In addition, local forest officers collect and submit specimens to secure identification and forage value of each plant submitted. All plants are identified by the department and notes are assembled and disseminated by members of the grazing investigative force of the Forest Service. This plan will be continued, and the data as rapidly as available will be disseminated among local forest officers and through them to stockmen by reporting on plant collections submitted for identification.

Cooperation.—Office of Economic and Systematic Botany, Bureau of Plant Industry.

Distribution and Economic Importance of Herbaceous and Shrubby Plants on National Forest Ranges—Continued.

Location.—Collection of specimens and notes, on all national forests; identification of specimens and assembling of notes, at Washington, D. C.

Date begun.—1911.

Results.—Approximately 23,000 specimens have been collected and identified since 1911, 6,500 during the past fiscal year, and notes on approximately 2,000 species returned to collectors. The result is the gradual education of forest officers and stockmen as to the identification, requirements, and value of the herbaceous and shrubby plants which make up the forage crop on approximately 100,000,000 acres of lands used for grazing within national forests, with a consequent improvement in the management of the grazing on these lands.

Assignment.—W. A. Dayton, W. R. Chapline.

Proposed expenditures, 1915-16.—$6,000.

Protection (Grazing):

Object.—To determine the effect of grazing upon tree reproduction, erosion, and stream flow, and to work out methods of handling stock so as to minimize or eliminate unwarranted injury due to grazing.

Procedure.—The effect of grazing upon tree reproduction and the extent to which injury can be decreased by changes in grazing management and methods of handling stock localities which are typical of large regions are studied. Special areas are then selected on cattle range, sheep range, and goat range to represent various conditions of slope, aspect, soil, vegetation, and different tree species. Numerous small plats are located, definitely marked, and all tree growth examined from two to four times during the year for a period of three to five years, depending upon species under consideration, class of stock, and range conditions. Fenced areas are always provided to permit a comparative study of reproduction and vigor of reproduction under protection against grazing and under the existing systems of grazing. The extent of injury from grazing by different classes of stock during the various seasons of grazing, under different methods of handling, and on the various range types is thus determined. With these data as a basis, a system of grazing management which will allow the maximum use of range consistent with permissible damage to forest growth is worked out. The major field work in the study of sheep and cattle grazing on conifer timber lands was completed at the end of the past field season. Reexamination of all plats every three years for a period of 10 to 15 years is proposed. A study of sheep and cattle grazing on aspen lands is well under way and will be continued. A study of goat grazing will be started during the field season of 1915. Grazing as a factor in causing erosion and floods from the high mountain lands is the major problem of the Utah Experiment Station. Two areas comparable in every way are under comparative study—one under grazing and the other totally protected against grazing. All "run-off,' both water and sediment, is measured accurately, and all necessary meteorological data are collected throughout the year. The plan contemplates having the factor of grazing the only variable one in the comparative study, the other factors being either the same or in a definite constant relation for the two areas. This plan will be continued throughout the period of study. The intensive study will be supplemented by general observations throughout the national forests.

Cooperation.—Office of Economic and Systematic Botany, Bureau of Plant Industry.

Location.—Coconino Forest, Ariz., Shasta Forest, Cal., Payette Forest, Idaho, Manti Forest, Utah, and Alamo and Gila Forest, N. Mex., for specific studies; general observations throughout national forests.

Date begun.—1911.

Results.—Major field work has been completed in the study of sheep and cattle grazing on conifer timberlands and suggestions for changes in management of range and stock are furnished to local forest officers. It has been found that, by care in placing cattle and sheep on range best adapted to each class of stock and by following the "open-herding bedding-out" system of handling sheep, much of the damage done in the past to tree reproduction, forage crop, and in starting erosion can be

Protection (Grazing)—Continued.

avoided. Suggested improvements are being put into practice in national-forest administration.

Assignment.—A. W. Sampson, R. R. Hill, W. A. Dayton, W. R. Chapline, W. N. Sparhawk.

Proposed expenditures, 1915–16.—$5,200.

Methods of Handling Stock Under Range Conditions:

Object.—To reduce to a minimum the waste of forage in utilizing the range and to minimize the cost of efficient handling both to stock owners and to the Forest Service. The work involves studies to determine the most satisfactory size of band, method of herding, salting, watering, and lambing in the case of sheep; and, for cattle, methods of control and handling throughout the grazing period.

Procedure.—The investigations on this project were begun with a band of sheep on a typical mountain summer sheep range placed under coyote-proof fence. A comparative study of handling under fence and handling under the old system of herding on open range was conducted through a period of four years to learn the natural habits of sheep under fence, the necessary restrictions in order to herd sheep successfully without fences on different kinds of range, and possible advantageous changes in existing methods of handling. These studies resulted in the "open-herding bedding-out" system of herding sheep. Studies since 1911 have aimed at working out variations in this system for different localities, and at the same time have served to demonstrate the advantages of the new over the old system. All studies are made under practical range conditions and are always a comparative study of the existing systems and the methods proposed, in order that results will be conclusive both as to practical application and advantages of the new methods. The problem of range lambing has been attacked in the same way. Studies and demonstration tests along these lines are contemplated until all sheep on national-forest ranges are handled under the improved methods. In 1912 similar studies were started on a small scale with cattle. These studies will be materially broadened and made more comprehensive as regards different methods of handling and the advantages and disadvantages of each method, both to stock and range, by the investigations to be started during the summer of 1915 on the Jornado and Santa Rita Grazing Reserves in the Southwest.

Cooperation.—Office of Economic and Systematic Botany, Bureau of Plant Industry, and Mr. S. T. Turney, Las Cruces, N. Mex.

Location.—Madison Forest and Beartooth Forest, Mont.; Payette Forest, Idaho; Lassen Forest and Inyo Forest, Cal.; Cochetopa Forest, Colo.; Datil Forest and Jornada Grazing Reserve, N. Mex.; and Santa Rita Grazing Reserve, Ariz.

Date begun.—1907.

Results.—(1) Development of the "open-herding bedding-out" system of herding sheep, which is now in application on approximately 50 per cent of sheep ranges within national forests, with a resultant increase of 10 per cent in carrying capacity and 5 pounds increase in weight of lambs where the new system is followed; (2) improved methods of handling sheep under range conditions during the lambing season, which are proving efficient under practical application by sheep owners; (3) information of value relative to drift and division fences to control cattle on national-forest ranges; (4) publication of Forest Service Circulars 156, 160, and 178, Forest Service Bulletin 97, and a number of papers in outside journals, especially a series of six papers in the National Wool Grower beginning with the March issue, 1915.

Assignment.—J. T. Jardine, C. E. Fleming, A. E. Aldous, F. D. Douthitt.

Proposed expenditures, 1915–16.—$7,500.

Distribution and Development of Stock-Watering Places:

Object.—To determine the distribution of stock-watering places necessary for different classes of stock under various conditions of topography and forage, in order to properly utilize the range; and to collect data as to the best methods of developing stock-watering places under conditions existing throughout the western ranges.

Procedure.—Observations were made in 1913 on 700 watering places developed on national-forest ranges prior to that date, with a view to find-

Distribution and Development of Stock-Watering Places—Continued.

ing out the methods most satisfactory for a given set of local conditions and with a view to securing data relative to proper distribution of water under given conditions of topography, range, and class of stock. The conclusions were published in Farmers' Bulletin 592. Observations are being continued on projects developed prior to and since 1912. No special experiments are being conducted. In connection with the investigations proposed for the Jornada and Santa Rita Grazing Reserves in the Southwest, special study will be made to determine proper distribution of watering places as well as cost and methods of developing water on the semidesert ranges of the Southwest.

Cooperation.—Office of Economic and Systematic Botany, Bureau of Plant Industry, and Mr. S. T. Turney, Las Cruces, N. Mex.

Location.—Jornada and Santa Rita Grazing Reserves and national forests.

Date begun.—1913.

Results.—Farmers' Bulletin 592 furnishes information as to the importance of properly distributed watering places to efficient range management and gives concise suggestions as to methods of developing and protecting watering places. The general result has been a more aggressive effort on the part of forest officers and stock owners to develop adequate water for the maximum production of stock on available range.

Assignment.—J. T. Jardine, C. E. Fleming.

Proposed expenditures, 1915–16.—$300.

Eradication of Poisonous Plants:

Object.—After information is furnished by the Office of Poisonous-Plant Investigations, Bureau of Animal Industry, as to the species which are poisonous to stock, the class of stock to which each species is poisonous, and the state of growth at which it is poisonous, there still remains the big task of learning the distribution of each species throughout the national forests and working out methods of protecting stock against poisoning. The distribution is gradually being determined through the project "Distribution and economic importance of herbaceous and shrubby plants on national forest ranges." Loss of stock from poisoning is being gradually reduced by (1) locating and posting poisonous-plant areas with warnings; (2) fencing poisonous-plant areas to hold stock off until they can safely graze the areas in question; (3) grazing larkspur areas within cattle range by sheep before the cattle are put on the range; (4) eradicating the poisonous plants; and (5) more careful handling of the stock, such as by following the "bedding-out" system of herding sheep, which avoids much loss resulting from improper handling. The object of the investigations under this project is to find out the most efficient methods of eradicating the poisonous plants, the conditions under which eradication is practicable, the conditions under which it is practicable to use sheep in removing larkspur annually from cattle ranges, the conditions under which the cost of constructing drift or pasture fences as a protection against loss from poison is feasible, and to ascertain the extent to which poisonous-plant areas can safely be grazed if improved methods of handling are followed.

Procedure.—Actual eradication by cutting at different stages of growth, by digging up the plants, and by the use of chemicals are made under range conditions. Actual tests of grazing larkspur areas throughout the cattle range by sheep are being made. Many fences have been constructed and the results in the way of eliminating loss are being observed. In all cases record is kept to determine the cost of preventive measures adopted as compared with the value of live stock saved from poisoning. It is planned during the coming year to make a practical test of eradicating larkspur from one range on the Stanislaus Forest in California, to continue the sheep-grazing tests on the Ruby and Mono Forests in Nevada, to continue experiments on methods of eradication at the Utah Experiment Station, and to start tests in eradicating loco by the use of chemicals on the Pike Forest in Colorado.

Cooperation.—Office of Economic and Systematic Botany, Bureau of Plant Industry; Office of Poisonous-Plant Investigations, Bureau of Animal Industry; and stockmen on the national forests.

Location.—Stanislaus Forest, Cal.; Ruby and Mono Forests, Nev.; Manti Forest, Utah; Pike Forest, Colo.

Eradication of Poisonous Plants—Continued.

Date begun.—1912.

Results.—It has been shown that under certain conditions eradication of tall larkspur by grubbing out the plants is practicable; that loss of cattle from larkspur poisoning can be eliminated where the larkspur patches can be grazed off by sheep before the cattle are put on the range; that loss of sheep can be decreased by following the "bedding-out" system of herding; and that construction of drift fences is a matter of economy under many conditions.

Assignment.—J. T. Jardine, A. W. Sampson, A. E. Aldous, L. H. Douglas, F. D. Douthitt, Mark Anderson.

Proposed expenditures, 1915–16.—$1,300.

Checking Erosion in Mountain Meadows:

Object.—To determine the possibility of checking erosion and silting up of gullies by constructing small dams in erosion gullies; also the possibility of checking erosion and improving mountain meadows by diverting the small streams at the heads of meadows so as to distribute the water over the surface of the meadow rather than allow it to concentrate in one channel. Observations as to cost and rate of silting up gullies are made.

Location.—Sierra and Kern Forests, Cal.

Date begun.—1912.

Results.—A series of five dams was constructed on one meadow of the Sierra Forest in 1912 and repaired in 1913; dam-construction work done on one meadow on Kern Forest in 1914; streams diverted at the heads of three meadows on the Kern Forest; erosion stopped on one meadow at a reasonable cost.

Probable date of completion.—1920.

Assignment.—F. D. Douthitt.

Proposed expenditures, 1915–16.—$150.

Climatic Characteristics of Vegetative Belts on the Manti Forest:

Object.—To obtain and correlate exact measurements of climatic factors which limit the distribution of species and bring about distinct plant formations or vegetative types locally on the Manti Forest.

Procedure.—It is proposed to make observations in the oak, aspen, and Engelmann spruce associations at 7,000 feet, 8,700 feet, and 10,000 feet, respectively, under similar conditions of slope and exposure. The following factors will be recorded throughout the season: Air temperatures by thermographs; soil temperatures, 6, 12, and 24 inches deep, read at 8 a. m. and 6 p. m.; soil moisture, 10-day periods, at 6, 12, and 24 inch depths; evaporation by means of the Livingston porous-cup atmometer and by exposure of free water surface; precipitation throughout the year with tipping bucket and standard rain gauges, and by snow-scale measurements and water-content determinations of snow.

Cooperation.—Weather Bureau; Office of Economic and Systematic Botany, Bureau of Plant Industry.

Location.—Utah Experiment Station, Manti Forest, Utah.

Date begun.—1913.

Results.—Observation stations have been selected, equipment installed, and records of all factors secured for approximately one year.

Probable date of completion.—1918.

Assignment.—A. W. Sampson.

Proposed expenditures, 1915–16.—$825.

Total, Range Investigation, $31,618.

FOREST-PRODUCTS INVESTIGATIONS.

Industrial and Statistical Investigations:

Object.—Industrial and statistical studies of the production and consumption of lumber and other forest products; studies of wood-using industries as to methods, costs, etc., mechanical methods of utilizing wood waste, compilation of lumber and stumpage prices, wood utilization, specifications and grading rules, lumber distribution; and cooperation with the Federal departments in the purchase and handling of lumber and revision of Government specifications. Studies are followed by commercial application of the results.

Industrial and Statistical Investigations—Continued.

Procedure.—Annual statistics of lumber production are maintained in cooperation with the Bureau of the Census, Department of Commerce, and with the Bureau of Crop Estimates, of this department. Data obtained from previous studies of wood-using industries in various States have been compiled to show the consumption of lumber by the industries for a period of 12 months during the years 1909 to 1912. It is planned to conduct a similar canvass in connection with the next decennial census, if possible. A series of intensive industry studies has been undertaken for the purpose of ascertaining methods, costs, etc. To date such studies have considered cooperage, veneer, and boxes. A wood-waste exchange is maintained for the purpose of assisting manufacturers to obtain or sell waste suitable for the manufacture of small commodities. Quarterly records of lumber prices are compiled and all stumpage transfers reported in trade journals are followed up in order to secure advice as to the consideration involved for the information of timber-sales officers. The efficient utilization of wood is studied in connection with industry studies, the marketing of wood-lot products, etc. Studies of specifications and grading rules consider, when possible, quality of timber and its utilization through to use in final manufactured form. An important study of the adaptation of the manufacture and grading of lumber to more specifically meet the needs of particular industries and classes of consumers is under way. This study will pay particular attention to the utilization of oak and yellow pine from the stump to final manufacture. Advice is currently furnished the Federal departments as to purchasing and handling lumber, and from time to time navy yards, lumber shipments, etc., are inspected and specifications revised.

Cooperation.—Bureau of the Census, Department of Commerce; Bureau of Crop Estimates, Department of Agriculture; Panama Canal Commission; Navy Department; War Department; Indian Service; lumber manufacturers' associations and other trade organizations, and various State forestry officials.

Location.—Washington, D. C., with supervision of work at national-forest district headquarters.

Date begun.—1908.

Results.—Annual statistics of lumber have been obtained since 1905 and figures on other forest products until 1911. Complete data are available showing the consumption of lumber by the wood-manufacturing industries by States, industries, and species. The special-industry studies already under way have assisted greatly in national-forest and private timber utilization. The profitable manufacture of small commodities from waste material has been effected in many cases. The compilation of lumber prices forms part of a valuable continuous record maintained since 1908, which is of great service to the trade. The current prices assist in timber-sales administration. The compilation of stumpage values also assists in timber-sale administration. More efficient methods of wood utilization are pointed out in all publications and in correspondence. A special study of yellow-pine density grading determined the quality of available standing yellow pine in the Southern States, and in cooperation with the Forest-Products Laboratory a density-grading rule for yellow-pine structural timbers to be recommended by the Forest Service was drawn up. A utilization study of blight-killed chestnut conducted in cooperation with the Bureau of Plant Industry and State officials determined that sound dead chestnut was merchantable, pointed out and demonstrated the most profitable ways of utilizing chestnut, and located markets. The study has resulted in salvaging considerable dead chestnut in the Eastern States. State wood-using studies have been completed and results published for 34 States in cooperation with State officials or trade journals. A bulletin presenting data for the entire country is in preparation. Hickory-handle specifications prepared by the Forest Service have been adopted by the Panama Canal Commission, Navy Department, and War Department. The Panama Canal Commission is purchasing southern yellow pine under a density rule prepared by the Forest Service. Various other specifications of the departments have been revised. Eastern navy yards have been inspected and recommendations as to better methods of purchasing, handling, storing, and work-

Industrial and Statistical Investigations—Continued.

ing lumber put into effect. Numerous inspections of lumber shipments have been made for the above departments.

Assignment.—H. S. Betts.

Proposed expenditures, 1915–16.—$25,760.

Lumber-Industry Studies:

Object.—To secure authoritative information on the underlying causes of the present unsatisfactory conditions in the lumber industry, so that the Government may be in a position to deal constructively and helpfully with the situation, both from the standpoint of the public and the industry; to secure valuable data on methods and costs of logging and lumber manufacture and equipment employed, as a basis for stumpage appraisals and the development of proper relations between lumbering and forestry; to secure special information by mill-scale or depreciation studies in regard to yield and quality of lumber from different sizes and species of logs in different sections of the country, also the depreciation in value of lumber from the time it is cut until shipped, particularly for use in connection with appraisals of Forest Service stumpage.

Procedure.—Special investigators confer with leading men in the industry and visit carefully selected producing operations or distributing concerns, making field studies of operations and critical reviews and analyses of office records, or both. In the case of mill-scale and lumber depreciation studies, detailed grading and records of the logs and mill products are made.

Cooperation.—Department of Commerce, in the economic study of the lumber industry.

Location.—Washington, D. C.; Madison, Wis.; district offices; and national forests; also principal lumber producing and distributing regions outside of the jurisdiction of the Forest Service.

Date begun.—1912.

Results.—Logging-cost studies are reported in a publication on "Flume Construction" already issued. A number of mimeographed compilations for immediate use by forest officers in appraisals have been issued. Mill-scale studies have developed much valuable data on the most important species in Montana, Idaho, Washington, Oregon, and California; also on the effect which tapping for turpentine has on the quantity and quality of lumber secured from long-leaf pine.

Assignment.—W. B. Greeley, E. H. Clapp.

Proposed expenditures, 1915–16.—$14,460.

Forest-Products Laboratory:

(*a*) SUPERVISION—

Object.—Administration and supervision of experimental investigations in the use, handling, and preservation of timber products. This item includes all overhead charges, such as accounts and purchase, maintenance of quarters, publication, drafting, photography, designing, stenography, library, mail, and files.

Cooperation.—University of Wisconsin, Bureau of Plant Industry, and various engineering, chemical, and lumber associations and societies. The building in which the laboratory is located is furnished by the University of Wisconsin, while the cost of maintenance is borne by the Forest Service.

Location.—Madison, Wis., with branch offices at San Francisco, Cal.; Missoula, Mont.; Portland, Oreg.; and Seattle, Wash.

Date begun.—1906.

Assignment.—E. H. Clapp, H. F. Weiss, H. S. Betts, and C. P. Winslow at Madison, Wis.; C. S. Smith at San Francisco, Cal.; H. B. Oakleaf at Portland, Oreg.

Proposed expenditures, 1915–16.—$38,200.

(*b*) TIMBER PHYSICS—

Object.—To secure information relating to the microscopic structure of wood in relation to its properties and uses, to methods of kiln drying, and to the principles involved in the change in the properties of wood when subjected to different physical conditions.

Procedure.—The work involves an exhaustive study by use of the microscope and photomicrographs of the structure of woods and also intensive experiments with semicommercial apparatus on methods of kiln-drying

Forest-Products Laboratory—Continued.

(*b*) TIMBER PHYSICS—

wood and the effect on its properties of conditioning or treating under high pressures, temperature, etc.

Cooperation.—University of Wisconsin, various lumber manufacturers, etc.

Location.—Madison and Mellen, Wis., and Roanoke, Va.; expectations for further work in Montana and California.

Date begun.—1903.

Results.—A new type of kiln has been developed which permits the drying of certain hardwoods from the green condition without preliminary air seasoning. The problem of satisfactorily drying western larch in this kiln has also been solved. During the past year this kiln was installed by two companies. Several publications have been issued. A method has been determined for distinguishing the various species of southern yellow pine.

Assignment.—H. D. Tiemann.

Proposed expenditures, 1915–16.—$17,800.

(*c*) TIMBER TESTS—

Object.—To secure reliable information and data on the mechanical properties of various species and forms of timber for the use of engineers, manufacturers, and other users of wood, enabling them to employ various species and forms most advantageously and making possible improvements in grading rules and specifications.

Procedure.—The work involves exhaustive tests of the mechanical and physical properties of small clear specimens of woods of different species and similar tests of timbers of structural sizes, and to some extent tests with especial forms of material, such as packing boxes, barrels, shipping containers, etc.

Cooperation.—University of Wisconsin and University of Washington.

Location.—Madison, Wis., and Seattle, Wash.

Date begun.—At Madison, 1909; at Seattle, 1906.

Results.—Approximately 109,000 tests have been made at the Madison laboratory on small clear specimens, 31,000 such tests being completed in 1914. These tests cover intensive data on over 100 American species. Also many tests were completed on structural timbers, especially Douglas fir and southern yellow pine, on shipping containers for the safe transportation of explosives, and on packing boxes. New grading rules and specifications for southern yellow-pine structural timbers have been prepared. Similar work for Douglas fir is in preparation.

Assignment.—J. A. Newlin, at Madison, Wis.; C. W. Zimmerman, at Seattle, Wash.

Proposed expenditures, 1915–16.—$26,500.

(*d*) WOOD PRESERVATION—

Object.—To secure data which will promote the protection and preservation of wood from destruction by decay, fire, abrasion, and insects.

Procedure.—The work involves the determination of the physical and chemical properties of preservatives and fire retardants, intensive studies of the ways and relative ease with which preservatives may be injected into different species, pathological studies to determine the relative resistance of treated and untreated woods to decay, and technological investigations of semicommercial apparatus as regards methods of most efficiently treating with various preservatives woods of different kinds and forms.

Cooperation.—University of Wisconsin.

Location.—Madison, Wis.

Date begun.—1903.

Results.—Tests on over 30 wood preservatives on the market have been completed, including an intensive study of the physical and chemical properties of various types of creosotes. Comparative information on the relative ease of treatment of conifers has been completed, and similar studies on hardwoods are under way. Many data have been secured on the effect of fundamental variables in applying treatments on the efficiency of the process. During 1914 special attention was devoted to methods of rendering wood fire retardant.

Assignment.—C. H. Teesdale.

Proposed expenditures, 1915–16.—$19,500.

Forest-Products Laboratory—Continued.

(*e*) WOOD DISTILLATION AND DERIVED PRODUCTS—

Object.—To secure information on the suitability of different woods and wood waste for products other than the wood which may be derived from them. The work deals with wood distillation, naval stores, production of grain alcohol from sawdust, the generation of producer gas from wood waste, etc.

Procedure.—In the wood-distillation work, production of ethyl alcohol, etc., technological studies are conducted on a semicommercial basis to determine the effect of the fundamental variables on the efficiency of the process and to determine the suitability of different forms and species of woods. In the naval-stores work there is involved, in addition to studies on distillation, similar technological investigations of extraction methods, etc., and actual studies in the field on the yields of resins secured from different species and the most efficient methods of turpentine operations. The work further involves intensive scientific and chemical investigation looking to the analysis of the products which may be secured and to their refinement and the possible new products which may be thereby produced.

Cooperation.—Bureau of Chemistry, University of Wisconsin, University of Washington, and various engineering, chemical, and lumber associations and societies.

Location.—Madison, Wis.; Seattle, Wash.; and Bogalusa, La.

Date begun.—1907.

Results.—In work on the destructive distillation of hardwoods a method has been developed whereby the yield of alcohol and acetate of lime may be greatly increased. These tests have been partially demonstrated on a commercial scale. Progress was made in determining the effect of some of the fundamental variables involved in the production of ethyl alcohol from wood waste. Tests have also been completed on the quantity and character of oils which may be secured from leaves and twigs of conifers, and these oils are under commercial test to determine their usefulness. Investigations of the suitability for distillation of several woods which have not formerly been used have been completed. This work includes California black oak and eucalyptus. Tests are under way on other woods, special attention being given to Douglas fir and western yellow pine.

Assignment.—S. F. Acree.

Proposed expenditure, 1915–16.—$20,500.

(*f*) PULP AND PAPER INVESTIGATIONS—

Object.—To secure information on the suitability of different woods for the manufacture of pulp of various kinds, and to determine methods for increasing the efficiency of the various processes both new and established.

Procedure.—The work involves technological experiments on semicommercial apparatus, coupled with detailed chemical analyses and examinations and a microscopic study of wood structure, pulp fibers, etc.

Cooperation.—University of Wisconsin and the Bureau of Chemistry.

Location.—Madison, Wis.

Date begun.—1905.

Results.—The suitability of 23 species of wood, of which 13 have not heretofore been used for ground-wood pulp, has been tested, together with the determination of the effect which variations in power, pressure upon stone, sharpness of grindstones, etc., have on the quality and yield of the pulp. Exhaustive tests have also brought out the most efficient methods for operation of the soda process, and in a less intensive measure similar information has been secured with the sulphate process, especially with respect to long-leaf pine mill waste. Apparatus has been designed for determining exactly the relative glare of different papers and also their tearing strength, both of which properties have an important bearing on their suitability for different purposes.

Assignment.—S. D. Wells.

Proposed expenditures, 1915–16.—$21,000.

Total, Forest-Products Investigations, $183,720.

Total, Forest Investigations, $317,265.

ALLOTMENTS BY UNITS OF ORGANIZATION.

Washington, D. C.:	
General office and field work	$505.405
Madison laboratory	128,000
Appalachian	497,160
State cooperative fire protection	100.000
Fire fund	150,000
Total	1,380,565
District 1, Missoula, Mont.:	
District office and field work	107,500
National Forests:	
Absaroka	20,390
Beartooth	14,774
Beaverhead	18,915
Bitterroot	24,192
Blackfeet	25,712
Cabinet	18,033
Clearwater	20,893
Coeur d'Alene	37,187
Custer	10,100
Dakota	1,301
Deerlodge	35,613
Flathead	37,835
Gallatin	15,935
Helena	17,930
Jefferson	23,302
Kaniksu	32,587
Kootenai	34,770
Lewis and Clark	16,491
Lolo	28,925
Madison	15,991
Missoula	19,476
Nez Perce	22,152
Pend Oreille	23,352
St. Joe	29,905
Selway	24,854
Sioux	9,647
Improvement fund	86,000
Roads and trails for States	69,020
Reserve (fire protection)	11,976
Land classification	15,000
Entry survey	19,000
Products	3,000
Range investigation	900
Planting fund	42,000
Silvical investigation	6,600
Reconnoissance	15,500
Total	956,758
District 2, Denver, Colo.:	
District office and field work	90,420
National Forests:	
Arapaho	18,142
Battlement	16,425
Bighorn	19,569
Black Hills	33,009
Bridger	10,049
Cochetopa	14,901
Colorado	14,609
Durango	16,846
Gunnison	17.341
Harney	21,280
Hayden	17,128
Holy Cross	16,966
Kansas	3,134
Leadville	17,141
Medicine Bow	19,914
Michigan	9,360
Minnesota	11,040
Montezuma	14,640
Nebraska	9,835
Pike	29,935
Rio Grande	20,727
Routt	19,755
San Isabel	15,040
San Juan	15,104
Shoshone	18,400
Sopris	17,681
Superior	18,624
Uncompahgre	19,837
District 2, Denver, Colo.—Contd.	
National Forests—Contd.	
Washakie	$19,080
White River	18,476
Improvement fund	50,000
Roads and trails for States	59,618
Reserve (fire protection)	5,107
Land classification	18,125
Entry surveys	18,000
Range investigation	1,200
Planting fund	40,000
Silvical investigation	9,450
Reconnoissance	2,700
Total	808,603
District 3, Albuquerque, N. Mex.:	
District office and field work	97,438
National Forests:	
Alamo	13,925
Apache	23,379
Carson	24,584
Chiricahua	9,858
Coconino	30,167
Coronado	18,686
Crook	12,335
Datil	26,729
Gila	27,475
Lincoln	13,191
Manzano	13,035
Prescott	22,075
Santa Fe	38,578
Sitgreaves	19,912
Tonto	17,525
Tusayan	25,563
Improvement fund	45,000
Roads and trails for States	51,877
Reserve (fire protection)	3,775
Land classification	12,000
Entry survey	18,500
Range investigation	1,885
Planting fund	7,000
Silvical investigation	6,600
Reconnoissance	8,850
Total	589,887
District 4, Ogden, Utah:	
District office and field work	89,080
Supply depot and property audit	126,280
National Forests:	
Ashley	15,065
Boise	16,947
Cache	19,549
Caribou	15,000
Challis	12,338
Dixie	9,425
Fillmore	15,673
Fishlake	12,760
Humboldt	10,709
Idaho	14,850
Kaibab	8,488
La Sal	11,154
Lembi	13,590
Manti	19,490
Minidoka	12,830
Nevada	12,344
Palisade	13,735
Payette	24,537
Powell	10,610
Ruby	6,470
Salmon	21,484
Santa Rosa	8,035
Sawtooth	16,453
Sevier	12,896
Targhee	15,282
Teton	15,380
Toiyabe	11,494
Uinta	20,327
Wasatch	15,385
Weiser	18,408
Wyoming	14,339

District 4, Ogden, Utah—Contd.	
Improvement fund	$52,500
Roads and trails for States	57,124
Reserve (fire protection)	16,709
Land classification	11,372
Entry surveys	10,500
Range investigation	6,450
Planting fund	24,508
Silvical investigation	2,150
Reconnoissance	23,400
Total	865,120
District 5, San Francisco, Cal.:	
District office and field work	117,360
National Forests:	
Angeles	41,570
California	31,497
Cleveland	21,217
Eldorado	23,738
Inyo	11,836
Klamath	36,276
Lassen	26,498
Modoc	18,334
Mono	11,061
Monterey	7,400
Plumas	38,494
Santa Barbara	31,624
Sequoia	37,066
Shasta	33,341
Sierra	34,050
Stanislaus	31,899
Tahoe	37,287
Trinity	36,084
Improvement fund	65,000
Roads and trails for States	35,740
Reserve (fire protection)	12,753
Land classification	12,000
Entry survey	5,000
Products	9,300
Range investigation	900
Planting fund	7,150
Silvical investigation	8,550
Reconnoissance	4,700
Total	787,225
District 6, Portland, Oreg.:	
District office and field work	106,520
National Forests:	
Cascade	17,935
Chelan	12,770
Chugach	15,161
Columbia	18,618
Colville	18,195
Crater	29,693
Deschutes	20,159
Fremont	19,345
Malheur	16,350
Minam	12,676
Ochoco	15,251
Okanogan	22,560
Olympic	24,007
Oregon	28,160
Rainier	24,980
Santiam	15,052
Siskiyou	24,260
Siuslaw	14,942
Snoqualmie	26,776
Tongass	25,124
Umatilla	12,345
District 6, Portland, Oreg.—Contd.	
National Forests—Contd.	
Umpqua	$21,526
Wallowa	20,217
Washington	16,442
Wenaha	12,759
Wenatchee	21,984
Whitman	23,867
Improvement fund	84,000
Roads and trails for States	48,245
Reserve (fire protection)	5,137
Land classification	24,661
Entry survey	11,000
Products investigation	10,860
Planting fund	29,955
Silvical investigation	5,550
Reconnoissance	15,400
Land exchange (Washington)	50,000
Total	922,482
District 7, Washington, D. C.:	
District office and field work	17,880
National Forests:	
Arkansas	27,220
Florida	15,442
Luquillo	3,900
Ozark	25,294
Wichita	4,925
New forest areas:	
Cherokee	4,263
Georgia	3,857
Massanutten	2,822
Monongahela	2,742
Mount Mitchell	4,729
Nantahala	3,973
Natural Bridge	4,507
Pisgah	6,221
Potomac	2,990
Savannah (North)	2,126
Savannah (South)	4,201
Shenandoah	4,277
Smoky Mountains	2,127
Unaka	1,886
White Mountains	8,055
White Top	3,417
New areas	6,500
Improvement fund	15,000
Reserve (fire protection)	4,679
Land classification	1,700
Entry survey	300
Planting fund	2,000
Reconnoissance	1,000
Roads and trails for States	7,098
Total	195,131
Grand total	6,505,771

Unallotted contingents:		
Improvements	$2,500	
Land classification	10,067	
Survey, etc	2,700	
Planting	5,027	
Silvical investigations	1,778	
Miscellaneous investigations	1,040	
Reconnoissance	250	
		23,362
Total, Forest Service		6,529,133

BUREAU OF CHEMISTRY.

GENERAL ADMINISTRATION.

Office of Chief:

Object.—General administration of the research, regulatory, and business affairs of the bureau.
Cooperation.—Other bureaus of the department.
Location.—Washington, D. C.
Date begun.—1902.
Assignment.—C. L. Alsberg.
Proposed expenditures, 1915–16.—$12,000.

Office of Assistant Chief:

Object.—To assist the chief in bureau administration.
Location.—Washington, D. C.
Date begun.—1902.
Assignment.—R. L. Emerson, A. S. Mitchell, S. H. Ross.
Proposed expenditures, 1915–16.—$21,000.

Office of Chief Clerk:

Object.—To supervise the clerical work of the bureau.
Location.—Washington, D. C.
Date begun.—1902.
Assignment.—F. B. Linton.
Proposed expenditures, 1915–16.—$8,500.

Accounts:

Object.—Supervision and maintenance of financial records of the bureau.
Location.—Washington, D. C.
Date begun.—1902.
Assignment.—J. G. Coleman.
Proposed expenditures, 1915–16.—$10,400.

Supplies:

Object.—Purchase, receipt, maintenance, and distribution of supplies.
Location.—Washington, D. C.
Date begun.—1914.
Assignment.—S. A. Postle.
Proposed expenditures, 1915–16.—$12,900.

Mail and Files:

Object.—Handling and filing incoming and outgoing mail, and messenger work.
Location.—Washington, D. C.
Date begun.—1907.
Assignment.—P. Perrone.
Proposed expenditures, 1915–16.—$10,000.

Stenographic Work:

Object.—To assist offices and laboratories in general stenographic work.
Location.—Washington, D. C.
Date begun.—1914.
Assignment.—L. F. Shipe.
Proposed expenditures, 1915–16.—$9,200.

Editorial Work:

Object.—Preparation of manuscripts for publication.
Cooperation.—Division of Publications.
Location.—Washington, D. C.
Date begun.—1902.
Assignment.—G. O. Savage.
Proposed expenditures, 1915–16.—$3,000.

Library:

Object.—To circulate the books and periodicals of the bureau library and to secure books and information desired by the workers from libraries in and outside of Washington; to buy and care for books and journals bought with bureau funds for the field laboratories; to index and translate food and drug legislation; reference and bibliographical work.

Cooperation.—Department library; other libraries in and out of Washington.

Location.—Washington, D. C.

Date begun.—1902.

Assignment.—A. E. Draper.

Proposed expenditures, 1915–16.—$5,500.

Superintendence of Building:

Object.—To perform the mechanical and cleaning work of the bureau.

Cooperation.—Department shops.

Location.—Washington, D. C.

Date begun.—1912.

Assignment.—F. M. Allen.

Proposed expenditures, 1915–16.—$17,000.

Total, General Administration, $109,500 (research, $36,500; regulation, $73,000).

[Research.]

INVESTIGATIONS IN AGRICULTURAL CHEMISTRY.

CHEMISTRY OF PLANT GROWTH.

Influence of an Early Application of Plant Food on Growth and Composition:

Object.—To determine the necessity for an early application of fertilizers.

Procedure.—It is planned to grow wheat seedlings in solution cultures containing different amounts of plant food and different kinds of plant food and then to transplant these seedlings in the field, all under the same conditions. Whatever differences may be found at harvest will have been due to the early treatment of the seedlings.

Cooperation.—In 1914 this work was conducted in cooperation with the Bureau of Plant Industry at its Mandan (N. Dak.) substation.

Location.—Mandan, N. Dak., and Washington, D. C.

Date begun.—1914.

Results.—The crop at Mandan was harvested, weighed, the amount of straw and seed determined, and samples of both seed and straw sent to the Bureau of Chemistry and analyzed. The analytical results show that some influence has been exerted by the treatment with phosphoric acid, but conclusions should not be drawn until this work shall have been finished.

Probable date of completion.—1917.

Assignment.—J. F. Breazeale.

Proposed expenditures, 1915–16.—$700.

Study of the Chemistry of Plants during Their Growing Period:

Object.—To determine what chemical and physiological changes are taking place in plants during the growing period.

Procedure.—During the period of growth small samples of the growing plants representing a definite area are sent to the laboratory for analysis.

Cooperation.—Office of Dry-Land Agriculture Investigation, Bureau of Plant Industry.

Location.—Washington, D. C., and field stations of the Bureau of Plant Industry.

Date begun.—1909.

Results.—A great many analytical results have been obtained, but they have not yet been put in shape to be interpreted, and no definite results can be stated yet. This work has been carried on for several years. During the past year there was a temporary abandonment of this project, but it may be taken up at any time, depending upon the amount of routine work that has to be done in the laboratory.

Probable date of completion.—1918.

Assignment.—J. F. Breazeale, L. H. Bailey.

Proposed expenditures, 1915–16.—$500.

Changes in Growing Plants under Controlled Chemical and Physical Treatment:

Object.—To study the effect of recognized plant-food constituents and of other inorganic elements and likewise the effect of light (sunlight and colored light) on plant growth, and to follow the changes which take place during the growth of plants.

Procedure.—Either field plants or greenhouse plants are treated with plant food and the effect of the treatment on plant growth noted. Plants are analyzed at various stages of growth in order to determine the amount of the various constituents formed during the growing period. The work on these experiments is to a large extent determined by the amount of routine work necessary in the laboratory.

Cooperation.—Maryland Experiment Station.

Location.—Washington, D. C., and College Park, Md.

Date begun.—1910.

Results.—The work on the influence of the calcium-magnesium ratio on root development showed that the root growth was not affected (under the conditions of the bureau's experiments) by differences of calcium or of magnesium in the solution culture. The results of some of this work have been published in Bureau of Chemistry Bulletin 139.

Probable date of completion.—1918.

Assignment.—J. F. Breazeale, Jehiel Davidson.

Proposed expenditures, 1915–16.—$400.

Total, Chemistry of Plant Growth, $1,600.

INFLUENCE OF ENVIRONMENT ON CROPS AND PLANTS.

Influence of Environment on the Composition of Cereals:

Object.—To determine what rôle is played by the composition of the seed and the effect of environment on the composition of the crop.

Procedure.—A definite sample of seed is grown in each of three localities varying in climatic conditions. Seed from the three resulting crops is grown in each locality in small plats, side by side, all under the same climatic conditions. Each year the crop is analyzed and the results noted.

Cooperation.—Office of Cereal Investigations, Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1905.

Results.—Bureau of Chemistry Bulletin 128, giving the results of three years' work, has been published. Subsequent results confirm the findings as published in Bulletin 128, namely, that the climate plays the predominant part in influencing the composition of grains. This is evident from the fact that at each locality the crop of the three plats is identical in appearance and composition; but the crop of the three plats of any one locality is different from that grown in the other locality.

Probable date of completion.—1920.

Assignment.—J. A. Le Clerc, Jehiel Davidson.

Proposed expenditures, 1915–16.—$1,000.

Influence of Soil and Climate on Plant Composition:

Object.—To determine what influence on the composition of plants may be attributed to climatic agencies and to soil.

Procedure.—Small plats of soil 5 feet square and 3 feet deep were interchanged between each of three localities, namely, College Park, Md., Hays, Kans., and Davis, Cal. In each of these three localities the same wheat is grown and crop analyzed. This is being continued yearly.

Cooperation.—Office of Cereal Investigations, Bureau of Plant Industry.

Location.—Washington, D. C.; College Park, Md.; Hays, Kans.; and Davis, Cal.

Date begun.—1908.

Results.—The results of the first four years' work has been published in the Journal of Agricultural Research. The results indicate that the soil as such plays a minor part in influencing the composition of wheat. For example, the wheat grown on each of the three soils in Maryland varies from 10 to 13 per cent in protein, while on the same soils in Hays, Kans., the wheat contains from 18 to 20 per cent protein. The appearance of

Influence of Soil and Climate on Plant Composition—Continued.

the wheat grown in each plat in Maryland is identical, but is entirely different from the wheats grown on the same soil in Kansas.

Probable date of completion.—1920.

Assignment.—J. A. Le Clerc, Jehiel Davidson.

Proposed expenditures, 1915–16.—$800.

Influence of Environment on the Composition of Plants Other than Cereals:

Object.—To obtain data regarding the effect of various environmental factors on the characteristics of plants.

Procedure.—The same varieties of seeds are grown in different localities. These samples from the crop are analyzed in order to determine the variations due to the climatic conditions in which they were grown.

Cooperation.—Offices of Cereal Investigations and Forage-Crop Investigations, Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1905.

Results.—Observation shows that the composition of a crop depends to a large extent upon the climatic conditions prevailing during the growing season. About 500 samples of soy beans have been and are being analyzed. These beans represent many varieties and have been grown in about a dozen places. The results of this work will not be apparent for several months.

Probable date of completion.—1918.

Assignment.—J. A. Le Clerc, L. H. Bailey.

Proposed expenditures, 1915–16.—$400.

Influence of Different Soils upon the Composition of Wheat:

Object.—To determine the influence which soils have on the composition of wheat in contradistinction to that effected by other environmental agencies.

Procedure.—It is proposed to transport to the Arlington Experiment Farm, in Virginia, one three-hundred-and-twentieth of an acre of soil 3 feet deep, consisting of 16 tons each of sandy clay, marl, muck, and a good agricultural soil, and in each one of these soil plats it is planned to grow the same seed.

Cooperation.—Office of Cereal Investigations, Bureau of Plant Industry.

Location.—Arlington, Va., and Washington, D. C.

Date begun.—1915.

Probable date of completion.—1920.

Assignment.—J. A. Le Clerc, Jehiel Davidson.

Proposed expenditures, 1915–16.—$1,600.

Study of the Chemistry of Grains Typical of the Different States:

Object.—To obtain more thorough knowledge of the quality of grains grown in the different States.

Procedure.—It is proposed to obtain samples of wheat and of other cereals typical of the various parts of the country, especially east of the Mississippi River, and to analyze them.

Cooperation.—Office of Cereal Investigations, Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1905.

Results.—This project is similar to the one on "Influence of environment on the composition of plants other than cereals," and the results on wheat grown in the West show that climate exerts the greatest influence on the composition. Already considerable work has been done with samples west of the Mississippi River, but practically no work has been done with samples in the eastern part of the country.

Probable date of completion.—1920.

Assignment.—J. A. Le Clerc, L. H. Bailey.

Proposed expenditures, 1915–16.—$200.

Changes in Composition Which Grains Undergo on Storing:

Object.—To see what chemical and physical changes take place in cereals in storage.

Procedure.—Samples of wheat, corn, rye, barley, and oats were taken in 1908, analyzed immediately, and again analyzed after a period of six months, one year, a year and a half, and so on. These samples have now been kept for over six years and will be again analyzed.

Changes in Composition Which Grains Undergo on Storing—Continued.

Location.—Washington, D. C.

Date begun.—1908.

Results.—The results obtained showed that no great change was apparent in so far as the protein, fat, fiber, and pentosans were concerned, but that, especially in the case of corn, there was a big change (a decrease) in the amount of sugar. These results were published in the Journal of the American Chemical Society several years ago.

Probable date of completion.—1916.

Assignment.—Jehiel Davidson.

Proposed expenditures, 1915–16.—$100.

Influence of Stacking and Shocking Wheat on the Quality of Flour:

Object.—To note what effect, if any, the stacking and the shocking of wheat have on the quality of the flour. This study may have an important bearing in explaining the differences in the qualities of the wheat grown in the West, where some wheats are stacked and others are harvested by the use of headers.

Procedure.—Samples of wheat are collected in the field, some of them being stacked and some shocked. Samples of each of these are sent to the laboratory for analysis and for milling and baking.

Cooperation.—Offices of Cereal Investigations and Grain Standardization, Bureau of Plant Industry.

Location.—Washington, D. C.; Fargo, N. Dak.; Manhattan, Kans.; and Decatur, Ill.

Date begun.—1912.

Results.—One year's work has been done. The wheat, whether shocked or stacked, was milled and the flour baked at different periods of the year. The results showed quite a difference in loaf volume and quality of the bread, but such results should be corroborated by further experiments before making any definite statement.

Probable date of completion.—1918.

Assignment.—W. O. Gordon, H. L. Wessling.

Proposed expenditures, 1915–16.—$200.

Value of Leaves of Different Species for Manurial Purposes:

Object.—To obtain data showing value of leaves for manurial purposes.

Procedure.—Samples of leaves of definite type and variety will be analyzed, in order to determine the amount of plant food contained in them.

Cooperation.—Office of Economic and Systematic Botany, Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1909.

Results.—The results of analysis show a marked difference in the composition of different varieties of leaves, and it is therefore to be expected that different kinds of leaves would have different manurial value.

Probable date of completion.—1918.

Assignment.—J. F. Breazeale, L. H. Bailey.

Proposed expenditures, 1915–16.—$100.

Loss of Plant Constituents in Different Varieties of Hay and Other Plants When Subjected to Rain:

Object.—To determine the amount of plant food and other constituents which may be removed from plants by the action of rain. The knowledge thus obtained will be of benefit in subsequent plat and pot experiments which may be instituted in order to determine the amount of food required by plants, and will show the necessity of more careful curing of hay.

Procedure.—Samples of hay are harvested and allowed to dry in the field. When dry a portion of this sample is collected and analyzed, the other portion of the sample being allowed to remain in the field until soaked by rain. The hay is then allowed to dry again, then resampled, and both the well-cured and the badly cured hay analyzed. Hay likewise cured in the field is subjected to a process of leaching in the laboratory, in order to imitate the action of rain in the field. This hay is then dried and analyzed.

Cooperation.—Maryland Experiment Station and Bureau of Plant Industry.

Location.—Washington, D. C.; Arlington, Va.; and College Park, Md.

Date begun.—1907.

Loss of Plant Constituents in Different Varieties of Hay and Other Plants When Subjected to Rain—Continued.

Results.—The results obtained in the laboratory by subjecting hay to a certain amount of leaching show that a large part of the sugar, protein, and ash constituents are lost. This probably explains why dry hay which has become thoroughly wet by rain is not so sought after by cattle as is good, well-cured hay.

Probable date of completion.—1916.

Assignment.—J. F. Breazeale, L. H. Bailey.

Proposed expenditures, 1915–16.—$500.

Total, Influence of Environment on Crops and Plants, $4,900.

STUDIES OF MILL PRODUCTS.

Wheat and Prepared Cereal Products:

Object.—To determine (*a*) methods for the valuation of wheat, flour, bread, and macaroni; (*b*) effect of various factors on the quality of flour and prepared products; (*c*) composition of wheat, flour, bread, breakfast food, and macaroni.

Procedure.—Wheat is ground in the bureau's experimental mill and the various samples obtained on the various rolls analyzed, in order to become familiar with the character of the products each process produces. The flour produced from the milling is made into bread. Other wheat products, such as macaroni and breakfast foods, are also analyzed, in order to obtain full knowledge regarding their characteristics.

Cooperation.—Offices of Cereal Investigations and Grain Standardization, Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1909.

Results.—The results obtained show the relation between the composition of wheat and of flour made therefrom, and the difference in composition between the products of the various bread and smooth rolls. This study has given an insight into the composition of the various grades of flour and the kind of bread to expect from each grade. No work has been done with breakfast foods. The work with macaroni is progressing in such a way as to be of material help in determining the quality of these products.

Probable date of completion.—1920.

Assignment.—W. O. Gordon, H. A. Piper.

Proposed expenditures, 1915–16.—$1,000.

Study of Semolina Produced from Different Wheats:

Object.—To determine the grades of semolina that may be made from different varieties of wheat.

Procedure.—It is intended to obtain samples of the best class of wheat used in the production of semolina for the purpose of manufacturing macaroni and to compare such samples of wheat and macaroni with other samples of wheat, as semolina (or flour) used in making ordinary macaroni.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1918.

Assignment.—W. O. Gordon, H. A. Piper.

Proposed expenditures, 1915–16.—$1,000.

Influence of Carbon Dioxid on the Keeping Quality of Flour:

Object.—To obtain data regarding the influence of carbon dioxid on the life of weevils and other insects and on the baking qualities of flour.

Procedure.—It is proposed to transfer flour into a number of tin cans and to exhaust the air from these cans, and then to allow air-free cans to become filled with carbon dioxid, after which the cans will be sealed and kept for a number of months or years, in order to determine the effects of the carbon dioxid. It is also proposed to allow a similar number of cans containing the same kind of flour to remain, all unopened, for the same length of time under normal conditions.

Location.—Washington, D. C.

Date begun.—1915.

Influence of Carbon Dioxid on the Keeping Quality of Flour—Continued.

Probable date of completion.—1920.

Assignment.—W. O. Gordon, H. A. Piper.

Proposed expenditures, 1915–16.—No allotment; work temporarily suspended.

Influence of Vacuum on the Characteristics of Gluten and on the Keeping Quality of Flour:

Object.—To obtain data regarding the influence of lack of oxygen on the life of weevil and other insects affecting flour and on the characteristics of the gluten and baking qualities of the flour.

Procedure.—It is proposed to place flour in tin cans from which the air will be entirely excluded, and in this condition to keep the cans for a number of months or years, after which they will be opened and the characteristics of the gluten compared with that of flour kept in the same kind of can under ordinary conditions.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1920.

Assignment.—W. O. Gordon, H. A. Piper.

Proposed expenditure, 1915–16.—No allotment; work temporarily suspended.

Influence of Drying Flour in Vacuum on Its Keeping Quality and on the Characteristics of the Gluten:

Object.—To determine what influence drying at different temperatures has on the life of weevils and other insects of flour and what influence this drying has upon the baking quality of the flour.

Procedure.—It is proposed to dry flour at different temperatures in a vacuum bath and to note the effect of the drying on the subsequent keeping of the flour and on the characteristics of the gluten, such flours being compared with the same kind of flour kept under normal conditions.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1920.

Assignment.—W. O. Gordon, H. A. Piper.

Proposed expenditures, 1915–16.—No allotment; work temporarily suspended.

Studies on the Composition and Utilization of Soy Beans:

Object.—To obtain information regarding the composition and method of preparing soy-bean products and concerning the chemical changes which take place in the preparation of these products.

Procedure.—Already over 500 samples of soy beans have been or are being analyzed, especially for fat and protein. The procedure will be as follows: Select samples of soy beans rich and poor in fat, respectively, and likewise rich and poor in protein, and determine which one is best suited for the manufacture of the soy-bean product in question.

Cooperation.—Office of Forage-Crop Investigations, Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1915.

Assignment.—J. A. Le Clerc, H. A. Piper.

Proposed expenditures, 1915–16.—$300.

Total, Studies of Mill Products, $2,300.

STUDIES IN BREAD MAKING.

Study of the Methods of Bread Making with Soft Winter-Wheat Flour:

Object.—To be able to make a good commercial bread from a soft winter-wheat flour, following possibly the methods used in France, where a similar flour is employed in bread making and where the quality of the bread is of the finest excellence.

Procedure.—It is proposed to obtain information regarding the methods in vogue for the production of the best French bread and to use these methods in connection with so-called soft-wheat flours. In doing this it will be necessary to visit bakeries where French bread is made and to obtain other information from various sources.

Study of the Methods of Bread Making with Soft Winter-Wheat Flour—Con.

Cooperation.—French bakeries in some of our large cities.

Location.—Washington and certain cities where French bakeries are to be found.

Date begun.—1915.

Probable date of completion.—1920.

Assignment.—H. L. Wessling.

Proposed expenditures, 1915–16.—$500.

Study of Various Yeasts and Malt Extracts in Baking:

Object.—To make bread with the use of compressed dry yeast and other forms of yeast and to study the effect of substances which may improve the quality of flour in bread making.

Procedure.—It is proposed to obtain all the various samples of yeast found on the market and to determine the best method for the making of bread by the use of these various yeasts. Samples will be obtained of various malt extracts and of similar products used in baking to test the efficacy of these on the same kind of flour.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1918.

Assignment.—H. L. Wessling.

Proposed expenditures, 1915–16.—$800.

Use of Part Substitutes for Flour in Baking:

Object.—To study the adaptability of such substances as flour made from chestnuts, bananas, peanuts, soy beans, peas, corn, barley, oats, rye, kafir, dasheens, etc.

Procedure.—As many so-called flour substitutes as it has been possible to obtain have been and are being tested to see if, when used in combination with ordinary flour, a satisfactory loaf of bread can be made. The general procedure is to use 20 to 25 per cent of these flour substitutes with 75 to 80 per cent of a good spring-wheat flour.

Cooperation.—Various offices of the Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1913.

Results.—The results show that some 30 or more substitutes experimented with can be utilized in making a good, palatable loaf of bread when used to the extent of not more than 25 parts of flour substitute to 75 parts of flour. Successful experiments have been carried on with boiled-potato instead of with potato-flake flour, as a very good loaf of bread can be made by using 12 parts of boiled potato with 9 parts of ordinary flour.

Probable date of completion.—1916.

Assignment.—H. L. Wessling.

Proposed expenditures, 1915–16.—$500.

Total, Studies in Bread Making, $1,800.

MALTING.

Malting:

Object.—To obtain information regarding the quality of malt obtained from different kinds of barley when malted under different conditions.

Procedure.—Samples of various varieties of barleys are analyzed, and subsequently the malts are analyzed, in order to determine the changes which have taken place in the process of malting. This will afford information as to the value of the barley for malting purposes.

Location.—Washington, D. C.

Date begun.—1905.

Results.—After several years' work Bureau of Chemistry Bulletin 124 was published, giving results of the analyses of the barleys from various States of the country and the kind of malt produced therefrom. The work was done in collaboration with the Wahl-Heinus Institute of Technology, the malting being done under their supervision. Most of the analytical work, however, on the barleys and malt was carried on in the Bureau of Chemistry.

Probable date of completion.—1920.

Assignment.—W. O. Gordon, H. A. Piper.

Proposed expenditures, 1915–16.—$300.

MISCELLANEOUS ANALYSES.

Miscellaneous Analyses:

Object.—To obtain information regarding the composition of various plants and plant products for the different offices of the Bureau of Plant Industry and various laboratories of the department.

Procedure.—Whatever samples are sent to this laboratory are subjected to the desired chemical analysis, in so far as the laboratory is able to do it.

Location.—Washington, D. C.

Date begun.—1905.

Results.—During the past year over 1,600 samples have been received. Most of these (85 per cent) were from the Bureau of Plant Industry. Many of these samples have already been analyzed and reported upon, but a great deal remains yet to be done. Among the samples thus submitted many of them require work of a purely routine character, e. g., over 500 samples of soy beans, over 300 samples of waters, silts, and soils, over 100 samples of milo and kafir, 100 samples of rice, etc.

Assignment.—J. A. Le Clerc.

Proposed expenditures, 1915–16.—$7,000.

LEATHER AND TANNING INVESTIGATIONS.

Investigations of the Wearing Quality of Sole Leather:

Object.—To determine (1) the effect of various tanning processes on quality, (2) the relative value of leather made from different sections of the hide, (3) the quality of various tannages.

Procedure.—Perfecting devices necessary prior to actual machine tests. Different leathers will be tested to determine their endurance under the test. This work will be continued along these lines until results having practical significance are obtained. Wearing tests and complete analyses of the leathers will also be made. During 1915–16 work to perfect a machine and secure preliminary results will be undertaken.

Location.—Washington, D. C.

Date begun.—1913.

Results.—A testing machine has been designed and built, and certain necessary attachments have been satisfactorily proved. Wearing and analytical data on leathers to be used in the experiments have been obtained.

Probable date of completion.—1917.

Assignment.—J. S. Rogers, F. M. Allen.

Proposed expenditures, 1915–16.—$1,067.

Disposal of Tannery and Leather Wastes:

Object.—(1) To profitably utilize tannery and leather wastes, (2) to distribute information on the agricultural value of these wastes, and (3) to prevent the pollution of drainage waters by such wastes.

Procedure.—Data on tannery-waste disposal and treatment are compiled from various sources. The experience of those who have installed plants is sought, with full data as to efficiency, in order to make the matter of value to all. Analyses of recovered products are made to determine their agricultural value. Suggestions and advice are supplied on the subject.

Cooperation.—American Leather Chemists' Association, National Association of Tanners, individual tanneries, and Hygienic Laboratory.

Location.—Washington, D. C.

Date begun.—1913.

Results.—Information has been compiled showing that it is feasible to purify tannery-waste liquors by well-established and simple processes and that the wastes thus recovered may be disposed of for agricultural purposes, sometimes at a profit. Analyses of a number of wastes and recovered products have been made. A second article covering recent information on tannery wastes has been published in the Journal of the American Leather Chemists' Association. Data are being compiled on the agricultural value of waste, and information has been furnished the tanning industry through correspondence.

Probable date of completion.—1917.

Assignment.—F. P. Veitch, R. W. Frey.

Proposed expenditures, 1915–16.—$352.

Investigations of the Composition of Leather and Tanning and Finishing Materials:

Object.—(1) To furnish the public useful information in the purchase of leather and leather articles, (2) to secure helpful information on the composition of these materials, (3) to show the relation between the composition and quality of the materials, and (4) to improve existing methods of examination and devise new methods where needed.

Procedure.—The materials are examined by chemical, physical, and microscopical methods for normal and abnormal and harmful constituents, and the effect of the presence of such constituents is noted. Old methods of testing are critically examined and improved or new ones substituted when needed. The work is essential as a foundation for advanced practical work.

Cooperation.—Association of Official Agricultural Chemists, American Leather Chemists' Association, and International Association of Leather Trades Chemists.

Location.—Washington, D. C.

Date begun.—1906.

Results.—Assistance has been given in the study and improvement of methods of examining tanning materials, oils, and greases and tanning products in general. The results obtained have been published for the information of chemists from time to time in the Journal of the American Leather Chemists' Association, and Bureau of Chemistry Bulletin 165 on the composition of American sole leather has been issued. During 1915 a quick and exact method for the determination of reducing sugars in leather has been completed and published. Methods for the determination of mineral acids in leather are being studied. Preliminary work has been done on the identification of tanning materials in mixtures. A test for the detection of chestnut and white oaks has been improved and the results published in the Journal of the American Leather Chemists' Association.

Assignment.—J. S. Rogers, R. W. Frey.

Proposed expenditures, 1915–16.—$952.

Deterioration of Upper, Bookbinding, and Other Light Leathers:

Object.—(1) To discover the causes of and to prevent the deterioration of light leathers, (2) to eliminate the use of harmful materials in leather making, and (3) to conserve raw materials by making better leather.

Procedure.—Badly deteriorated as well as durable leathers are carefully examined to determine wherein they differ in composition, appearance, and physical condition, for the purpose of explaining the serviceability of the leathers. Cooperation has been established with a number of public libraries to compare the durability of binding leathers in service with the determined composition of the leathers.

Cooperation.—War Department, American Library Association, individual libraries, bookbinders, and tanners.

Location.—Washington, D. C.; libraries in New York City, Providence, R. I., and Newark, N. J.

Date begun.—1912.

Results.—The harmful effects of large and considerable quantities of sulphuric acid have been definitely shown; specifications suggested for durable leathers, especially for Government and library purposes; a number of deteriorated leathers examined.

Probable date of completion.—1917.

Assignment.—J. S. Rogers, R. W. Frey.

Proposed expenditures, 1915–16.—$952.

Tanning Sole and Harness Leather on a Small Scale:

Object.—To ascertain tanning methods which may be successfully and economically used by farmers and small shoe and harness makers in the tanning of sole and harness leathers on a small scale.

Procedure.—Small-scale tannings will be actually made with the simplest equipment, such as may be available on the farm. The procedures, equipment, and results will be minutely described and fully illustrated in a publication.

Cooperation.—Small tanners.

Location.—Washington, D. C.

Tanning Sole and Harness Leather on a Small Scale—Continued.
Date begun.—1914.
Assignment.—Assistant to be appointed.
Proposed expenditures, 1915–16.—$1,352.

Total, Leather and Tanning Investigations, $4,675.

PAPER INVESTIGATIONS.

Investigations on the Serviceability, Suitability, and Durability of Paper:

Object.—(1) To demonstrate the more rational and economic use of paper, in order to conserve paper-making materials; (2) to effect economies in and aid in the intelligent manufacture of paper, and thus conserve raw materials for more important uses; (3) to determine the factors which control the serviceability, suitability, and durability of papers for each of the purposes for which they are used; (4) to improve the quality of papers; (5) to aid in furnishing a basis for the intelligent interpretation of the characteristics of paper; (6) to obtain data upon which to base rational and definite specifications for paper; and (7) to improve methods, apparatus, and conditions of paper testing with a view to obtaining more accurate, uniform, and useful results therein.

Procedure.—The methods, apparatus, and conditions of paper testing will be carefully studied, improved, and elaborated, in order that the results of tests may be accurately interpreted and duplicated at will. Quick laboratory methods for serviceability, suitability, and durability will be devised and correlated with actual experience. The factors which determine the uses of paper will be carefully studied with the methods above mentioned. From the data thus obtained, improvements in processes of paper making will be devised which will insure paper better suited to specific uses, the more economical and conservative use of paper-making materials will be promoted, and more rational and definite specifications for papers for various purposes can be prepared.

Cooperation.—Government departments, libraries, and selected paper makers.

Location.—Headquarters, Washington, D. C.; brief field work at libraries and paper mills as occasions may arise.

Date begun.—1904.

Results.—Seven publications issued, covering methods and apparatus used in testing; specifications and general information on serviceability, suitability, durability, and economical use, and also on the conservation of raw materials. The general form and substance of the specifications developed in this laboratory have been adopted by the chief Federal purchasing agents as well as by scientific societies and by State governments and corporations. Existing methods and apparatus and conditions for paper testing have been investigated and their value, effects, and results determined. Methods, apparatus, and conditions of testing have been markedly improved. Many somewhat intangible results have followed: More intelligent and fairer competition in bidding on Government supplies; more regular delivery of specified material; use of more suitable paper for the purpose in hand; the more economical and conservative purchase of paper. Savings of many thousands of dollars on the purchases of the Government Printing Office and the Post Office and other departments have resulted from the specifying of more suitable or lighter papers following along the lines developed and constantly urged by the bureau in its publications and in its advisory capacity.

Assignment.—F. P. Veitch, C. F. Sammet, E. O. Reed.

Proposed expenditures, 1915–16.—$1,572.

INVESTIGATIONS OF WOODS AND WOOD PRODUCTS.

Wood Distillation:

Object.—(1) To improve methods and apparatus used in wood distillation, (2) to shorten the time of distillation, (3) to investigate the utilization of waste wood and encourage the production of marketable articles not heretofore recovered from the wastes, and (4) to secure information on processes and yields of products.

Wood Distillation—Continued.

Procedure.—Laboratory experiments are conducted to show the kind and quality of products obtained from different species of wood. Laboratory experiments are also under way to show the factors which control the quantity and nature of products, followed by field work at existing wood-distillation plants looking to improvements in equipment and methods of procedure and to increased yields.

Cooperation.—Selected wood distilleries and sawmills, as may appear advisable.

Location.—Headquarters, Washington, D. C.

Date begun.—1901.

Results.—Two publications have been issued giving much general information on the principles, equipment, costs, processes, products, and profits of wood distillation. Field experiments on a commercial-unit size have been conducted on resinous wood, resulting in shortening the time of distillations, thereby decreasing the cost of equipment and increasing production to the same extent. Many data on yields of products have been collected. Examination of products to determine exact yields and to acquire data on the progress and nature of reactions in distillations have been made during the past year.

Probable date of completion.—Experimental work already started to be concluded and data assembled for publication in 1916.

Assignment.—F. P. Veitch, M. G. Donk, C. F. Speh.

Proposed expenditure, 1915–16.—$1,135.

Distillation of Idaho Wood:

Object.—To determine yields and value of products obtainable by distillation from waste woods of the far Northwest.

Procedure.—Experimental distillations of representative samples of mill waste, stumps, and dead and down timber of different species, to show the products and yields, are being conducted on an enlarged laboratory scale. If results indicate the feasibility of wood distillation, plans, specifications, and advice on installing commercial works will be prepared.

Cooperation.—University of Idaho.

Location.—Moscow, Idaho.

Date begun.—1914.

Results.—Equipment installed; preliminary work on stump burning in the field and the recovering of valuable by-products concluded with negative results; preliminary and very promising results obtained on western yellow pine and Port Orford cedar.

Probable date of completion.—1916.

Assignment.—M. G. Donk, Bureau of Chemistry, and W. D. Marshall, University of Idaho.

Proposed expenditures, 1915–16.—$1,252.

Total, Investigations of Woods and Wood Products, $2,387.

INVESTIGATIONS OF ROSIN AND TURPENTINE.

Improvement of the Quality of Rosin and Turpentine:

Object.—(1) To promote the production of higher grades of rosin and turpentine, (2) to simplify and lower the cost of production, and (3) to increase the yield of rosin from the gum.

Procedure.—Laboratory and field experiments and the demonstration of improved methods of distilling and straining will be made, to show that more and higher grades of rosin than it is now customary to produce can be made at possibly less cost by improved procedure. The work will require demonstrations at the stills. It can not be made effective through publications alone.

Cooperation.—Selected naval-stores producers.

Location.—Headquarters, Washington, D. C.; field work at 15 or 20 stills in North Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana. and Texas.

Date begun.—1913.

Results.—Laboratory work has indicated convincingly that much better and more rosin can be made from the gum than is now commonly produced. Field work is being conducted to learn how great may be the

Improvement of the Quality of Rosin and Turpentine—Continued.

improvement and the increased value of the product on a commercial scale and to familiarize the producers with the improved methods. The product of several stills has already been improved.

Probable date of completion.—Research work, 1916. Extension work along this line will be carried on.

Assignment.—F. P. Veitch, C. F. Sammet, C. F. Speh, V. E. Grotlisch.

Proposed expenditures, 1915–16.—$1,862.

Investigations of Wood Turpentine:

Object.—(1) To improve the quality of wood turpentine and (2) to secure additional information on the value of wood turpentine as a paint and varnish thinner.

Procedure.—Methods are developed on a laboratory scale for the satisfactory refining of wood turpentine. These methods are tried on an industrial scale and brought to the attention of wood-turpentine producers in publications. The experiences of paint and varnish makers and of painters is learned, and painting and varnishing experiments are made with wood turpentine.

Cooperation.—Wood distillers; paint and varnish makers.

Location.—Washington, D. C.

Date begun.—1904.

Results.—Investigations on the production, refining, and use of wood turpentine as a paint and varnish thinner have been made and results published. With this publication as a guide, the wood-turpentine distillers should be able to produce a well-refined marketable product suitable for paint and varnish thinning. Some additional work on more careful refining has been done.

Probable date of completion.—1916.

Assignment.—Assistant to be selected.

Proposed expenditures, 1915–16.—$352.

Methods of Analysis of Turpentine, Rosin, and Wood Products:

Object.—To devise accurate methods for determining the constituents in these articles, to serve as a basis for research work in production and for the preparation of specifications.

Procedure.—Many methods now used are erroneous. Accurate methods must be had. These are being devised by very careful trials on samples of known composition.

Cooperation.—American Society for Testing Materials.

Location.—Washington, D. C.

Date begun.—1906.

Results.—Marked improvements have been made in the methods for the examination of turpentine, pine oils, and certain distillation products. Results are issued in three publications, and data for several others are in hand.

Assignment.—M. G. Donk, C. F. Speh, H. P. Holman.

Proposed expenditures, 1915–16.—$828.

Production of Rosin Oil from Resinous Wood:

Object.—To devise methods for the refining and utilization of the heavy oils from resinous-wood distillation.

Procedure.—Methods for refining will be worked out in the laboratory, and these methods will be demonstrated at working plants.

Cooperation.—Wood distillers and rosin-oil users.

Location.—Washington, D. C.

Date begun.—Cursorily, 1901; actively, 1914.

Results.—Laboratory work gives warrant for the belief that useful rosin oil can be prepared from the heavy oils produced by the destructive distillation of resinous wood.

Probable date of completion.—1916.

Assignment.—H. P. Holman.

Proposed expenditures, 1915–16.—$792.

Total, Investigations of Rosin and Turpentine, $3,834.

WATERPROOFING AND MILDEWPROOFING FABRICS FOR FARM USE.

Waterproofing and Mildewproofing Fabrics for Farm Use:

Object.—To give farmers effective and cheap methods of waterproofing and mildewproofing fabrics for wagon covers, stack covers, and other farm uses.

Procedure.—It will be determined whether or not there are effective and cheap methods of waterproofing and mildewproofing which can be used safely and satisfactorily on the farm. If so, simple equipment and methods of procedure will be described so that farmers may carry out these processes satisfactorily. If there are no satisfactory and cheap methods of waterproofing and mildewproofing, an attempt will be made to devise methods, selected processes being submitted to actual use before a final conclusion as to the value of the processes is reached. This will involve small-scale experimental work, both at headquarters and possibly in cooperation with the manufacturers of waterproof and mildewproof fabrics and with one or more of the Government departments. Samples of waterproof and mildewproof fabrics which Government departments and other users have experimented with will be carefully examined in the laboratory, not only for their waterproof and mildewproof properties but to determine the nature of the materials used in waterproofing and mildewproofing.

Cooperation.—Manufacturers of waterproofed and mildewproofed fabrics; other Government departments.

Location.—Washington, D. C.

Date begun.—1915.

Results.—Some data collected.

Probable date of completion.—1917.

Assignment.—Assistant to be selected.

Proposed expenditures, 1915–16.—$352.

CARBOHYDRATE INVESTIGATIONS.

Investigations in the Manufacture of Sorghum Sirup:

Object.—To obtain analyses of genuine samples collected from makers located in all parts of the United States; to study the influence of seasonal variations, plant varieties, and methods of manufacture on the produce; to determine the effect of various clarifying agents; and to study methods of analysis.

Procedure.—Sirups were manufactured in Kentucky under various conditions. Samples of these and sirups from other localities are collected, analyzed, and studied.

Cooperation.—Bureau of Plant Industry; sirup makers located in a large sorghum district.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Thirty-three samples were manufactured in October, 1914, in Kentucky, and these, together with 35 samples collected from other localities, have been analyzed. Considerable investigation has been made in regard to a new method for the detection of the addition of glucose to sorghum sirup. At present the method gives promise of being very satisfactory.

Probable date of completion.—1917.

Assignment.—S. F. Sherwood.

Proposed expenditures, 1915–16.—$1,000.

Investigations in Cane-Sugar, Sirup, and Molasses Manufacture:

Object.—To obtain for analysis genuine samples of cane sirup from makers in various parts of the sugar-cane belt; to obtain samples of first, second, and third centrifugal molasses, also open-kettle molasses, for analysis; to determine the influence of seasonal variations and of cane varieties on the composition of the product; to ascertain the effect of various methods of manufacture on the products; to study the use of new methods of clarifying and filtering cane sirup; and to determine a possible use of invertase and other inverting agents in preparing cane sirup which will not granulate or ferment.

Investigations in Cane-Sugar, Sirup, and Molasses Manufacture—Continued.

Procedure.—As much of the experimental work as possible is carried out during the rather short cane-grinding season in the fall. Laboratory studies upon methods of inversion, clarification, and filtration are performed at Washington during the remainder of the year.

Cooperation.—Sirup makers in the sugar-cane belt; Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Sirups made by farmers and manufacturers have been investigated with reference to fermentation and crystallization. In this connection two trips were made into the field. Sirups were prepared from fresh cane that have remained clear and bright; also sirups that were inverted from 40 to 50 per cent and which have not crystallized, though containing 77 to 80 per cent of solids. It has been found that sirups containing about 22 per cent of water, or less, do not ferment readily, and that it is impossible to make a good sirup from fermented cane or cane containing red rot.

Probable date of completion.—1918 to 1920.

Assignment.—C. S. Hudson, J. K. Dale.

Proposed expenditures, 1915–16.—$4,000 (paid from appropriation for the Bureau of Plant Industry).

Investigation of the Composition of Vinegar Made from Cane and Sorghum Juices and of the Practicability of Making Such Vinegar on a Commercial Scale:

Object.—To find out whether a palatable vinegar can be made directly from cane and sorghum juices, and, if so, to determine its composition; also to determine as nearly as practicable the commercial possibilities of the manufacture of vinegar from these sources.

Procedure.—It is proposed during the first year to restrict the investigations to the production on a comparatively small scale of sufficient vinegar (perhaps 50 barrels) to permit its quality to be ascertained. Analyses of the material used and of the finished vinegar will be made. In the second year, if the results of the first year's work are such as to justify further work, the commercial possibilities of manufacture on a large scale will be investigated and more data on the composition of these vinegars accumulated.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1917.

Assignment.—R. W. Balcom.

Proposed expenditures, 1915–16.—$500.

Total, Carbohydrate Investigations, $5,500.

INSECTICIDE AND FUNGICIDE INVESTIGATIONS.

Destruction of Larvæ of the House Fly:

Object.—To prevent the breeding of the house fly in manure without destroying the fertilizing value of the manure.

Procedure.—Chemical or other substances will be determined which, when applied to piles of manure, will have a larvicidal and not a bactericidal action, and which will prove nontoxic to plant growth.

Cooperation.—Bureaus of Entomology and Plant Industry.

Location.—Washington, D. C., and New Orleans, La.

Date begun.—1913.

Results.—Borax and hellebore have both been found to be effective and practical larvicides, with no injurious action on the fertilizing value of the manure. Hellebore is recommended to be used on manure which is to be employed as a fertilizer, and borax in privies, refuse piles, etc. Publications: Department Bulletins 118 and 245.

Probable date of completion.—1915.

Assignment.—F. C. Cook, J. B. Wilson.

Proposed expenditures, 1915–16.—$1,570.

Toxic Effect of Sprays on Fruit Trees through the Medium of Soil:

Object.—To determine whether or not orchards can be injured by poisonous sprays acting through the medium of the soil and, if so, under what conditions this occurs and how to remedy it.

Procedure.—Samples of sprayed and unsprayed trees, which have or have not been treated with various poisonous spraying materials, and soils in which the same are growing, are collected by the Bureau of Entomology, with complete history of samples, and these samples are examined by the Bureau of Chemistry.

Cooperation.—Bureau of Entomology.

Location.—Washington, D. C.

Date begun.—1910.

Results.—Chemical work completed; data ready for collation, with the idea of publication in bulletin form.

Probable date of completion.—1916.

Assignment.—J. K. Haywood, C. C. McDonnell, W. B. Pope.

Proposed expenditures, 1915–16.—$500.

Foliage Injury by Lead Arsenate and Other Insecticides:

Object.—To determine what causes foliage injury by triplumbic arsenate; to determine the action of various impurities in lead arsenate on foliage; to discover spray mixtures which, while acting in an efficient manner as insecticides, will produce a minimum of injury to tender foliage.

Procedure.—Samples of known composition are prepared and subjected to test in the orchard and the results observed.

Cooperation.—Bureau of Entomology.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—1898.

Results.—It has been confirmed that diplumbic arsenate burns where triplumbic arsenate does not burn, and that certain by-products found in the preparation of lead arsenate do not burn. Results of part of the work have been published.

Assignment.—J. K. Haywood, C. C. McDonnell, W. B. Pope, W. D. Lynch.

Proposed expenditures, 1915–16.—Nominal; work incidental to other projects.

Analyses of Insecticides and Fungicides:

Object.—To aid other bureaus of the department, especially the Bureau of Entomology, in solving problems which require chemical investigations of an insecticidal or fungicidal nature.

Procedure.—When other bureaus of the department meet insecticidal and fungicidal problems which require chemical investigation, the facts are submitted to the Bureau of Chemistry and the necessary investigations undertaken to solve such problems.

Cooperation.—Principally the Bureaus of Entomology and Plant Industry.

Location.—Washington, D. C.

Date begun.—1900.

Results.—Ascertained facts are transmitted to the bureaus interested. Results of certain of these investigations have been published as bulletins of the Bureau of Chemistry. Other results have been published in Bureau of Entomology bulletins. During the past year investigations of chemical problems for the Bureau of Entomology have been made in connection with fumigation with hydrocyanic-acid gas; as to the amount of arsenic in bees and parts of bees feeding on blossoms sprayed with arsenicals; in connection with the preparation of new tree-banding materials and the preparation of insecticides used against certain insects on cotton; and analyses have been made of a considerable number of insecticides. An investigation was made for the Bureau of Plant Industry of the copper content of tomato plants which had been fed with copper through the medium of the roots. In the past the following publications have been issued under this project: Bureau of Chemistry Bulletins 82, "Paris Green Spraying Experiments"; 131, "Lead Arsenate"; and Bureau of Entomology Bulletin 90, part 3, "Chemistry of Fumigation with Hydrocyanic-Acid Gas."

Assignment.—J. K. Haywood, C. C. McDonnell, W. B. Pope.

Proposed expenditures, 1915–16.—$2,700.

Total, Insecticide and Fungicide Investigations, $4,770.

FRUIT AND VEGETABLE UTILIZATION INVESTIGATIONS.

Potato Drying for Stock Feed:

Object.—To prepare a high-grade stock feed from potatoes.

Procedure.—Potatoes are washed, ground, and pressed on a small commercial scale and the residue dried for stock feed. The by-products of this process are potato protein and potato juice.

Cooperation.—Office of Pomological and Horticultural Investigations, Bureau of Plant Industry.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—1914.

Results.—A plant has been erected at Arlington Farm of sufficient size to dry potatoes at the rate of one carload per day. The erection of this plant includes, besides the necessary building, the installation of a 75-horsepower boiler with steam connections, electric-power potato washer, elevator, grinder, roll press, and drier. The experimental roll press has been found to be less well suited for the drying of potatoes than for recovering the pulp left from the extraction of potato starch, for the reason that much starch is lost in the operation of pressing by this method. Other methods of pressing potatoes will be developed before conclusions can be drawn.

Probable date of completion.—Experimental work, 1916; extension work, consisting of the erection and operation of a demonstration plant in the field, then to be undertaken if results warrant.

Assignment.—H. C. Gore, R. H. Kent.

Proposed expenditures, 1915–16.—$4,500.

Manufacture and Utilization of Potato Starch:

Object.—To improve the present methods of preparing potato starch in the United States, and to increase its use in the arts and as a food.

Procedure.—Survey of present methods, followed by experiments in the improvement of methods of manufacture, in the manufacture from potato starch of dextrin and glucose, and in the extension of its use as a food.

Cooperation.—Office of Pomological and Horticultural Investigations, Bureau of Plant Industry.

Location.—Arlington, Va.

Date begun.—January, 1915.

Results.—Preliminary work has been done.

Assignment.—H. C. Gore.

Proposed expenditures, 1915–16.—$1,000.

Potato Analyses:

Object.—To determine the composition of potato samples submitted by the Bureau of Plant Industry.

Procedure.—Samples as submitted will be analyzed by usual laboratory methods in order to determine their chemical composition.

Cooperation.—Office of Pomological and Horticultural Investigations, Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Several hundred analyses were made during 1914–15.

Assignment.—F. T. Anderson.

Proposed expenditures, 1915–16.—$1,000.

Preparation of Ensilage from Potatoes:

Object.—To study the ensiling of potatoes by methods capable of being employed upon farms.

Procedure.—Isolation and propagation of active strains of desirable lactic-acid producing organisms, with simple procedure for the inoculation of substantial amounts of potatoes in underground concrete silos, or the equivalent, followed by the ensilage of potatoes in quantity and tests of their palatability and feeding value.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—1915.

Probable date of completion.—1916.

Assignment.—C. Thom, H. C. Gore.

Proposed expenditures, 1915–16.—$100.

Preparation of Cider Concentrated by Freezing:

Object.—To manufacture, from apples, pure apple cider sufficiently stable to endure transportation without the use of artificial preservatives.

Procedure.—The cider is frozen, crushed, and centrifugalized. The concentrated apple juice, which is thus removed from the ice, is then filtered.

Cooperation.—Office of Pomological and Horticultural Investigations, Bureau of Plant Industry.

Location.—Washington, D. C., and point in field to be determined.

Date begun.—1913.

Results.—Cider can be concentrated in this manner at a cost of less than 20 cents per gallon of the finished product. The finished product is sufficiently stable to endure transportation to market without the use of preservatives.

Probable date of completion.—Experimental work, 1916. Demonstration work, consisting of the erection and operation of a plant at some shipping point, will be taken up and continued.

Assignment.—H. C. Gore, R. H. Kent.

Proposed expenditures, 1915–16.—$3,000.

Manufacture of Sirup from Apples:

Object.—To further improve and demonstrate the preparation of sirup from surplus and cull apples.

Procedure.—Fresh cider treated with calcium carbonate, heated, filtered, and boiled down to a sirup.

Cooperation.—Office of Pomological and Horticultural Investigations, Bureau of Plant Industry.

Location.—Washington, D. C., and point in field to be determined.

Date begun.—1914.

Results.—Field investigations have shown that an attractive sirup can be prepared from apples on a small scale or large scale, using simple equipment. In consequence of the comparatively high price of the raw material, the preparation of sirup on a manufacturing scale can not be advised, but sirup making from apples on a domestic scale for utilizing culls already available is of promise. Improvements of the methods, with a view to producing on a large scale a sirup of higher quality than that produced up to the present time, are in prospect.

Probable date of completion.—Investigational work, in 1916.

Assignment.—M. G. Mastin.

Proposed expenditures, 1915–16.—$2,000.

Composition of Grape Juice:

Object.—To determine variations in composition from season to season of grapes of the eastern United States.

Procedure.—Preparation of grape juice and its analysis.

Cooperation.—Office of Pomological and Horticultural Investigations, Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1911.

Results.—Four years' work has been completed. Data have been obtained on the composition of the juices of many varieties of grapes.

Probable date of completion.—December, 1915.

Assignment.—F. T. Anderson.

Proposed expenditures, 1915–16.—$500.

Determination of Food Value of Fruit and Vegetable Products:

Object.—To determine the merits as food of fruit and vegetable products and to determine the chemical composition of new products made from fruits and vegetables.

Procedure.—The culinary quality and food use of fruit and vegetable products, such as sugar-beet sirup, cider concentrated by freezing, new fruit sirups, dried pressed potatoes, and potato starch will be tested.

Cooperation.—States Relations Service.

Location.—Washington, D. C.

Date begun.—1915.

Assignment.—C. F. Langworthy, H. C. Gore.

Proposed expenditures, 1915–16.—$250.

Preparation of Fruit Flavors from Surplus Fruits:

Object.—To prepare certain fruit flavors, in order to determine the best methods of preparing and preserving them.

Procedure.—Preparation of fruit flavors, consisting in concentrating the respective fruit juices by freezing and then preserving the concentrated juices by the use of grain alcohol.

Cooperation.—Office of Pomological and Horticultural Investigations, Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1916.

Assignment.—H. C. Gore.

Proposed expenditures, 1915–16.—$200.

Total, Fruit and Vegetable Utilization Investigations, $12.550.

CATTLE-FOOD AND GRAIN INVESTIGATIONS.

Composition and Value of Range Forage Crops:

Object.—To determine by analytical methods the composition and value of the forage crops growing naturally on the ranges of the arid and semiarid West.

Procedure.—Promising forage plants on ranges of the arid and semiarid West are collected by agents of the Bureau of Plant Industry and sent to Washington for analysis. The history and description of such samples are written by the Bureau of Plant Industry agent, and the combined results of the two bureaus, together with the average analysis of the same forage crops gathered by the Bureau of Chemistry, are published.

Cooperation.—Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1910.

Results.—Results of previous work collected and published in Department Bulletin 201; data now being obtained for two more bulletins on native forage crops.

Assignment.—J. K. Haywood, G. L. Bidwell.

Proposed expenditures, 1915–16.—$500.

Utilization of Waste By-Products as Cattle Foods:

Object.—To utilize as cattle foods various materials which are now waste products.

Procedure.—Factories will be visited, the waste products studied chemically, and promising waste materials tested on cattle; also methods of preparing the same in a form suitable for use will be studied.

Cooperation.—Various manufacturers.

Location.—Washington, D. C.

Date begun.—1913.

Results.—A number of manufacturing plants have been visited to obtain information in regard to problems to be solved. A preliminary investigation of waste yeast from breweries has been started, the composition of the article determined, and methods of preparation investigated.

Assignment.—J. K. Haywood, G. L. Bidwell.

Proposed expenditures, 1915–16.—$1,000.

Analyses of Cattle Foods and Grains:

Object.—To aid other bureaus of the department in solving problems in which the composition of cattle foods and grains is a factor.

Procedure.—Other bureaus carrying on cattle-food and grain investigations submit samples to the Bureau of Chemistry, which are examined.

Cooperation.—Bureau of Plant Industry and other bureaus of the department.

Location.—Washington, D. C.

Date begun.—1904.

Results.—Two to three hundred samples have been examined.

Assignment.—G. L. Bidwell.

Proposed expenditures, 1915–16.—$1,000.

Total, Cattle-Food and Grain Investigations, $2,500.

ISOLATION AND STUDY OF COMPOUNDS FROM THE COTTON PLANT, GOSSYPIUM HERBACEUM.

Isolation and Study of Compounds from the Cotton Plant, Gossypium Herbaceum:

Object.—To study the chemotropism of the boll weevil.

Procedure.—Various compounds are isolated from the cotton plant. These compounds are to be used by the Bureau of Entomology to study the chemotropism of the boll weevil. If it is found that the boll weevil is attracted to the cotton plant by some definite compound, this knowledge is to be used in fighting the boll weevil. The work will be carried on during the summer months on the growing cotton plant. If results warrant, the work will be continued from year to year.

Cooperation.—Bureau of Entomology.

Location.—Washington, D. C.

Date begun.—1915.

Assignment.—A. Viehoever, C. O. Johns.

Proposed expenditures, 1915–16.—$500.

Total, Agricultural Chemistry Investigations, $56,540.

COLLABORATION WITH OTHER DEPARTMENTS.

[Regulation.]

Tests for Post Office Department:

Object.—To conduct such investigations and make such analyses of foods, drugs, or other materials transported through the United States mails as the Post Office Department may request, with a view to preventing the use of the mails for fraudulent purposes.

Procedure.—Samples of the above-mentioned products as submitted by the Post Office Department will be analyzed by the usual laboratory methods. In cases where no official methods of analysis have been adopted, it may be necessary to develop methods. The work, on the whole, consists of the chemical analysis of food and drug products as submitted by the Post Office Department.

Cooperation.—Post Office Department and Department of Justice.

Location.—Washington, D. C.

Date begun.—About 1904.

Results.—As a result of the analyses made and reported, the Post Office Department has prohibited the shipment through the mails of a number of fraudulent medicines.

Assignment.—C. L. Alsberg, L. F. Kebler.

Proposed expenditures, 1915–16.—$2,000.

Testing Contract Supplies:

Object.—To determine the proper specifications for certain Government contract supplies and to determine whether the goods delivered comply with the specificaions.

Procedure.—Chemical or physical laboratory tests are made of the samples according to official methods of analysis. Only such samples are handled in this bureau as can not be handled by the Bureau of Standards.

Cooperation.—Departments of the Government and the General Supply Committee.

Location.—Washington, D. C.

Date begun.—1900.

Results.—Specifications have been developed for a large number of items and economies effected by requiring deliveries to be up to specifications. Assistance has been rendered the General Supply Committee in determining the quality of samples submitted with bids.

Assignment.—H. M. Loomis, F. P. Veitch, L. F. Kebler, C. S. Hudson.

Proposed expenditures, 1915–16.—$2,500.

Miscellaneous Tests for Other Departments:

Object.—To assist in classifying various products under the tariff act, and to make chemical analyses for other departments when requested to do so.

Procedure.—Samples as submitted by the Treasury or other departments

Miscellaneous Tests for Other Departments—Continued.

are analyzed according to official methods. When no official methods of analysis are available, suitable methods are devised.

Cooperation.—Treasury and other departments.

Location.—Washington, D. C., and bureau branch laboratories.

Date begun.—1900.

Results.—A large number of chemical analyses have been made for and reported to other departments.

Assignment.—R. L. Emerson.

Proposed expenditures, 1915–16.—$2,200.

[Research.]

Study of Cereal Dusts in Relation to Thrasher and Mill Explosions:

Object.—To study the physical and chemical properties of grain and cereal dusts which occur in the thrashing, storing, handling, and milling of wheat and other cereals, in order to determine the cause of explosions in thrashers and mills and to secure knowledge that will lead to the prevention of such explosions.

Procedure.—Samples of flour and other cereal dusts as found in thrashing, in grain elevators, and in mills are collected and a complete study of their chemical compositions and physical properties is made. In addition, the operations of thrashing, storing, and milling wheat and other cereals are investigated.

Cooperation.—Bureau of Mines; Millers' Association of New York State; Pennsylvania State College; Offices of Grain Standardization and Cereal Investigations, Bureau of Plant Industry; and Office of Public Roads and Rural Engineering.

Location.—Washington, D. C., and Buffalo, N. Y.

Date begun.—1914.

Results.—Considerable data have been collected in regard to past explosions. Laboratory experiments have been conducted in order to determine the relative inflammability of various dusts and the conditions under which they will explode. Considerable progress has been made in developing methods of analysis and in constructing apparatus to be used in the tests.

Probable date of completion.—1917.

Assignment.—G. A. Hulett, representing the Bureau of Mines, and D. J. Price and H. H. Brown, representing the Bureau of Chemistry.

Proposed expenditures, 1915–16.—$8,000.

Investigation of Distinctive Papers:

Object.—(1) To devise currency paper very difficult to counterfeit; (2) to give more individuality to bills of different denominations, in order to make bill "raising" more difficult; and (3) to increase the serviceability of currency paper.

Procedure.—Confidential; not to the best interests of the Treasury Department to make public.

Cooperation.—Bureau of Engraving and Printing, Bureau of Standards, paper makers, currency engravers and printers, and bankers.

Location.—Headquarters, Washington, D. C.

Date begun.—1913.

Results.—First report to the Secretary of the Treasury, November 7, 1913, recommending distinctive portrait, design, and color of bills of each denomination. A reduction in the cost of currency paper of $12,500 per year was also effected.

Probable date of completion.—July, 1916 (continuing at the request of the Secretary of the Treasury).

Assignment.—Committee on distinctive paper: F. P. Veitch and C. F. Sammet, Bureau of Chemistry, and F. C. Clark, Bureau of Standards.

Proposed expenditures, 1915–16.—$500.

Total, Collaboration with Other Departments, $15,200 (regulation, $6,700; research, $8,500).

[Regulation.]

TESTING EXPORT FOOD PRODUCTS.

Testing Export Food Products:

Object.—To inspect and test food products intended for export to foreign countries, to determine whether the goods will meet the requirements of the country to which consigned.

Procedure.—Samples are taken from shipments for export. The samples are subjected to the same tests as those required by the country to which shipped. The cost of examination is paid by the exporter.

Location.—New York and other branch laboratories.

Date begun.—1904.

Results.—All samples submitted have been analyzed and certificates of tests furnished.

Assignment.—R. E. Doolittle.

Proposed expenditures, 1915–16.—$4,280.

[Research.]

POULTRY AND EGG INVESTIGATIONS.

Poultry and Egg Research Work; General Laboratory Investigation:

Object.—To discover fundamental scientific facts bearing on the preservation of quality and the prevention of decay of poultry and eggs and their products.

Procedure.—Laboratory analyses are made and experimental studies conducted in the laboratory and in industrial environment on both a laboratory and a commercial scale. Investigations of the effects of various methods of preserving eggs and poultry are undertaken and laboratory and other methods devised by which researches can be carried on. New lines of work are originated and carried to the point of independent projects.

Cooperation.—Egg and poultry industry, warehousemen, and carriers.

Location.—Laboratories in Philadelphia, Pa., and Indianapolis, Ind.

Date begun.—About 1907.

Results.—New or modified chemical and bacteriological methods have been developed to detect decay or alteration in the composition of poultry and eggs. During the preceding year methods for the examination of eggs were given much attention. Results were obtained on the growth of bacteria at low temperatures; practical work developed in the preservation of eggs and on the use of refrigerated space for the preparation of poultry and eggs for market; an extensive correspondence carried on with producers and middlemen on subjects connected with the investigations.

Assignment.—Mary E. Pennington, Norman Hendrickson.

Proposed expenditures, 1915–16.—$21,580.

Breakage of Eggs in Transit:

Object.—To determine the cause of breakage, to fix responsibility, and to devise, test, and demonstrate methods by which damage in transit can be decreased.

Procedure.—Study of egg grading, egg packages, and stowing of loads in shipping sections; of conditions during transit on railroads and in trucks or wagons; details of handling at terminals, on docks, and in warehouses; handling by receivers.

Cooperation.—Office of Markets and Rural Organization; National Poultry, Butter, and Egg Association; shippers, railroads, egg-package industry, receivers, warehousemen.

Location.—In Middle West and east-coast cities.

Date begun.—1913.

Results.—Comprehensive survey of present practices in egg transportation completed. Experimental stowing of cars has resulted in definite recommendations to the industry on bracing eggs in cases, on bracing cases in cars, and bracing, buffing, and shifting cars in transit, resulting in a pronounced decrease in transit egg damage.

Probable date of completion.—1917.

Assignment.—Mary E. Pennington, H. A. McAleer, A. D. Greenlee, F. X. Daily.

Proposed expenditures, 1915–16.—$5,880.

Frozen and Dried Eggs:

Object.—To determine the fitness of certain eggs as food, and to study their handling before and after freezing and drying and their use by bakers and others, in order to save waste and improve quality.

Procedure.—Work in the laboratory and in the packing house on the grading of eggs before the candle and out of the shell, and on their subsequent handling, freezing, drying, and storage; examination of the products in bakeries when subjected to commercial routine handling.

Cooperation.—Office of Markets and Rural Organization, egg-breaking establishments, bakers, egg shippers, railroads, and cold-storage warehousemen.

Location.—East-coast cities and egg-producing sections in the Middle West.

Date begun.—1911.

Results.—Construction and equipment of egg-breaking plants and routine handling of eggs for preservation by freezing or drying practically completed; studies of egg products in bakeries practically completed; results now being prepared for publication.

Probable date of completion.—1916.

Assignment.—Mary E. Pennington, M. K. Jenkins, Norman Hendrickson.

Proposed expenditures, 1915–16.—$1,000.

Poultry Fleshing:

Object.—To study the behavior during killing, picking, chilling, packing, transporting, storing, and passage through the market of poultry fed after receipt by the packer for increase in weight and quality; and to determine the effect of different foods on the poultry during such preparation for market, in the packing house, and during its subsequent journey to the consumer, and the effect on its palatability and nutritive value to the consumer.

Procedure.—Differentiation of types of birds suited to feeding from incoming stock and the discarding of those birds that can not be successfully used for the following experiments: Caloric values, digestive coefficients, growth acceleration, specialized tissue formers, and such other information as may be necessary concerning the exact composition and effect of rations on poultry fed under the conditions and for the purposes stated; methods of administering rations—effect of quantities and frequency of feeding on the quality and composition of flesh; construction or development of quarters and appliances required for the commercial feeding of poultry in large numbers and in the unnatural environment of the packing house in order to procure a flesh of exact and constant composition; determination of best methods of emptying the intestinal tract during 24 hours preceding slaughter with a minimum loss of flesh; invention or development of special appliances and methods for the killing, bleeding, picking, chilling, and packing of the brittle-boned, tender-skinned, soft-meated birds resulting from heavy feeding in captivity; determination of the effect of transportation temperatures, holding-room temperatures, long-freezer storage, window displays, and the routine of marketing on the stability of the flesh of the dressed bird; and study of the character of the changes undergone.

Cooperation.—Bureau of Animal Industry, Office of Markets and Rural Organization; poultry packers having feeding stations, railroads, carriers in general, warehousemen, commercial men, jobbers, and retailers; nutrition experiments in the Bureau of Chemistry.

Location.—Poultry-packing houses in the Middle West, bureau laboratories in Indianapolis and Philadelphia, and east-coast cities.

Date begun.—1915.

Results.—The project is just being started. Because of the newness of the field and its extent, work during the coming year will be begun on the differentiation of types of birds coming to the packing house suited to feeding and general information of a scientific character obtained on the nutritive value of certain rations and their effect on the flesh of the birds.

Assignment.—Mary E. Pennington, H. A. McAleer, A. D. Greenlee, A. W. Broomell.

Proposed expenditures, 1915–16.—$3,400.

Instructing Shippers, Carriers, and Others in Handling Poultry and Eggs:

Object.—To disseminate information obtained in these investigations on the principles of handling eggs and dressed poultry, by personal contact,

Instructing Shippers, Carriers, and Others in Handling Poultry and Eggs—Continued.

demonstrations, publications, etc.; and to apply such principles in practical work as must be tested on a large scale in order to confirm their practicability.

Procedure.—Meetings at shipping and receiving points, presided over by investigators, to which all the industry, the railroad agents, etc., are invited; visits to shippers, receivers, warehousemen, etc., to observe methods in use and obtain and give general information; trips with demonstration car carrying refrigerator plant.

Cooperation.—Office of Markets and Rural Organization, buyers, shippers, railroads, warehouses, receivers of poultry and eggs, and State agricultural colleges.

Location.—Indiana, Illinois, Ohio, Kentucky, and east-coast cities, and occasionally minor activities in other States in producing sections.

Date begun.—About 1910.

Results.—General improvement has been effected in all phases of poultry and egg handling, transportation, and storage, and methods based on scientific findings have been introduced into general use in the industry, as evidenced by decreased spoilage of poultry and eggs in the markets.

Assignment.—Mary E. Pennington, H. A. McAleer, H. C. Pierce, A. D. Greenlee, F. X. Daily, H. L. Shrader.

Proposed expenditures, 1915–16.—$11,260.

Total, Poultry and Egg Investigations, $43,120.

[Research.]

FISH INVESTIGATIONS.

Freezing and Cold Storage of Fish:

Object.—To study present practices in handling fish for freezer storage, with a view to the prevention of loss through deterioration.

Procedure.—Chemical, bacteriological, and histological studies will be made of the effects of low temperature and different periods of storage upon fish handled in the commercial way. Trade practices in glazing, gutting, and wrapping fish for storage as a means of preservation will be investigated. It is planned to devise new scientific methods, if necessary, for detecting changes in fish during storage and for the detection of spoilage.

Cooperation.—Fishermen, dealers, and fish freezers.

Location.—Philadelphia, New York, and fish-producing points.

Date begun.—1914.

Results.—Extensive experiments involving long periods of freezer storage on fish treated in various commercial ways are in progress. These experiments must be repeated several years in succession for confirmation. New chemical methods have been devised to detect incipient deterioration in fish and similar products, and these methods have been successfully applied to the study of oysters and fish under refrigeration.

Assignment.—Mary E. Pennington, E. D. Clark, L. H. Almy.

Proposed expenditure, 1915–16.—$3,650.

Transportation and Handling of Fish:

Object.—Investigation of present methods of handling, packing, and shipping fish, in order to devise ways of improving the quality and preventing loss.

Procedure.—Chemical and other methods will be employed for studying the efficiency of present handling and shipping methods in conserving the quality of fish. Experimental shipments of fish will be made and handling studies instituted, in the hope of improving the quality of fish being shipped under present methods and also under any new methods which may be proposed.

Cooperation.—Transportation companies and fish dealers.

Location.—Fish producing and consuming centers and their shipping connections in the eastern and middle-western districts.

Date begun.—1915.

Assignment.—Mary E. Pennington, E. D. Clark, L. MacNaughton.

Proposed expenditures, 1915–16.—$5,780.

Systematic Food Analyses of Fish:

Object.—Chemical analyses of all available food fish to determine their food value and seasonal variations in composition.

Procedure.—Complete analyses of all available species of fish from the point of view of their food value will be made and compiled. The seasonal and local variations in the chemical composition of fish will be ascertained and the constants of their different food components determined.

Cooperation.—Bureau of Fisheries and fish dealers.

Location.—Washington, D. C., and Philadelphia.

Date begun.—1914.

Results.—Complete analyses of many fish have been made and compiled and show that the analytical tables already published are very inaccurate in that the fish were not analyzed at different seasons and the yearly average obtained. A tabulation of these results is under way and will prove of great value to all later investigators on the composition of American food fish.

Assignment.—Mary E. Pennington, E. D. Clark, T. E. Harper, jr.

Proposed expenditures, 1915–16.—$2,520.

Fish By-Products and New Sea Foods:

Object.—Investigation of the utilization of fish-waste products and new foods from fish, shellfish, and their commercial products.

Procedure.—Chemical and other methods in the laboratory and field will be employed for the study and development of commercial uses for fish oils, glue, gelatin, waste, etc. New uses for fish and fish products as foods or for other purposes will be developed after chemical study and practical work with the fish industries.

Cooperation.—Bureau of Fisheries, fish dealers, and fish by-product industry.

Location.—Philadelphia and fish-producing points on the east coast.

Date begun.—1915.

Assignment.—Mary E. Pennington, E. D. Clark.

Proposed expenditures, 1915–16.—$3,770.

Total, Fish Investigations, $15,720.

[Research.]

OYSTER AND OTHER SHELLFISH INVESTIGATIONS.

Investigations Regarding the Sanitary Inspection of Shellfish Areas and the Handling and Shipping of Shellfish:

Object.—To obtain information looking to the improvement of the sanitary quality of shellfish reaching the market.

Procedure.—A sanitary survey of oyster and clam beds will be made; also studies of shellfish in the various stages of marketing.

Cooperation.—Hygienic Laboratory and various State shellfish commissions and State boards of health.

Location.—Field laboratories are established in locations favorable to the study of the shellfish industry.

Date begun.—1913.

Results.—Shipments of shellfish from polluted areas investigated have been discontinued and conditions of handling improved.

Assignment.—Carleton Bates.

Proposed expenditures, 1915–16.—$4,250.

Investigations Regarding the Conservation of the By-Products of the Oyster Industry:

Object.—To secure data relative to the waste of the by-products of the oyster industry, with a view to ascertaining whether the same could be utilized on a commercial scale.

Procedure.—Information will be gathered in connection with work on projects covering the investigation of the handling of oysters.

Cooperation.—Oyster Growers' and Dealers' Association of North America.

Location.—Temporary laboratories established in connection with the handling of oysters.

Date begun.—1914.

Results.—Small amount of data available, collected during the investigations of 1914.

Assignment.—Carleton Bates.

Proposed expenditures, 1915–16.—$250.

Investigation of the Sanitary Character of Water in Relation to the Sanitary Condition of Shellfish:

Object.—To determine whether water in the vicinity of shellfish beds is polluted, to determine from what beds it is safe to obtain shellfish for food purposes, and to suggest methods for remedying or preventing the pollution of shellfish.

Procedure.—Inspection of conditions and examination of samples from the vicinity of shellfish beds will be made.

Location.—Washington, D. C.

Date begun.—1912.

Results.—This project has been confined since July, 1914, to the study and report of findings of the previous year's work. One report has been submitted, in cooperation with the Bacteriological Laboratory of the bureau, on the examination of the waters of Chesapeake Bay and its tributaries.

Probable date of completion.—1918.

Assignment.—W. W. Skinner, J. W. Sale.

Proposed expenditures, 1915–16.—$500.

Total, Oyster and Other Shellfish Investigations, $5,000.

[Research.]

BIOLOGICAL INVESTIGATIONS OF FOOD AND DRUG PRODUCTS.

Chemical Investigation of Vegetable Proteins:

Object.—To determine the chemical composition of proteins as a basis for ascertaining their food value; to investigate the hitherto unknown nitrogenous constituents of seeds and plants; to examine seeds and plants which are at present not used for foods, to ascertain whether these contain compounds which might be used to supplement the deficiency of other foods.

Procedure.—Isolation and hydrolysis of proteins from seeds and plants and a study of the composition and properties of such proteins.

Location.—Washington.

Date begun.—1915.

Assignment.—C. O. Johns, Arno Viehoever.

Proposed expenditures, 1915–16.—$7,400.

Nitrogen Distribution in Various Cereals and Other Feeding Stuffs:

Object.—To determine the nature and amount of the amino acids which are found in the mixed proteins of cereals and feeding stuffs. The isolation of the proteins themselves is tedious and inaccurate. The food value of a protein has been shown to depend on the nature and quantity of the amino acids, which are the building stones of the protein, and that certain of these amino acids are necessary for the growth and maintenance of animals. The knowledge of the presence or absence of these amino acids should lead to improvements in methods of feeding. The proposed research is designed to supply this information.

Procedure.—The various seeds and feeding stuffs will be hydrolyzed with acid which liberates the amino acids, and these will be determined by the methods of Van Slyke and Osborne.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Nitrogen distribution was determined in whole corn, corn germ, cottonseed flour, tomato seed, and Kafir corn. Confirming the results of previous investigators, corn, corn germ, and cotton seed were found by the bureau to contain the amino acids necessary for growth and maintenance. Tomato seed and Kafir corn both show absence of the amino acid, histidin, which is deemed necessary. The method of Van Slyke for determinations of the various amino groups can be applied to the analyses of various materials without previously isolating the proteins and without actually isolating the amino acids. Obviously this is an improvement over the former methods.

Probable date of completion.—June 30, 1916.

Assignment.—C. L. Alsberg, J. F. Brewster.

Proposed expenditures, 1915–16.—$1,800.

Effect upon Health of Feeding Small Quantities of Saponins for Long Periods:

Object.—For some years saponins have been used in various food products, notably in soft drinks for the purpose of making them foam. "Saponins" is a term covering a wide range of compounds, many of which are extremely poisonous and all of which possess the power in very great dilution of dissolving red blood corpuscles. The use of certain saponins in food products is undoubtedly objectionable. Whether others less toxic are permissible is open to question. All the experimental work with saponins hitherto recorded has been done with large doses, so that no conclusions can be drawn which are of value in guiding this bureau in the enforcement of the food and drugs act. In the proposed experiments small dosages, comparable with those in foods, will be employed in order to see whether evidence may be gathered that can be used to support a prohibition of the use of saponins.

Procedure.—Inasmuch as the feeding of small quantities of saponins to animals over long periods is often without visible effect, and inasmuch as the chief toxic action of saponins is on red blood corpuscles, it is proposed to feed animals for long periods with small quantities of saponins and then examine the resistance of their red corpuscles to laking.

Location.—Washington, D. C.

Date begun.—1914.

Results.—The results thus far obtained indicate that there is a distinct effect upon the red corpuscles, which is more marked in some cases than in others.

Probable date of completion.—1918.

Assignment.—C. L. Alsberg, C. S. Smith.

Proposed expenditures, 1915–16.—$500.

Utilization of Hydrogenated Whale Oil:

Object.—To determine whether hydrogenated whale oil can be used as an edible fat for lard substitutes.

Procedure.—Pure whale oil will be fed to experimental animals and the amount of fat absorbed determined, as well as the amount of cetyl alcohol excreted.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Work on this project will probably be completed this fiscal year and the results published.

Probable date of completion.—1916.

Assignment.—C. L. Alsberg, C. S. Smith.

Proposed expenditures, 1915–16.—$300.

Total, Biological Investigations of Food and Drug Products, $10,000.

[Research.]

CITRUS BY-PRODUCTS INVESTIGATIONS.

Citrus By-Products Investigations:

Object.—To devise commercial methods for the utilization of cull citrus fruits; especially to increase the quantity and quality of the yield of essential oils from the peel and of the juice from the fruit; to improve methods of the manufacture of citric acid; to extract products with flavoring value from the peel; to develop methods for concentrating and preserving citrus juices by freezing; and to study methods of manufacturing vinegar, marmalade, distilled oil, and other by-products from citrus fruits.

Procedure.—Methods for obtaining by-products are studied in the laboratory and later worked out on a small commercial scale. Experiments are made with different types of apparatus and machinery to ascertain which types are best adapted to the purpose of extracting or manufacturing the various by-products. Different methods are tried out in the same way.

Location.—Los Angeles, Cal.

Date begun.—1911.

Results.—Improved methods of clarification, filtration, and washing in the manufacture of citrate of lime, which have been devised and tried out on a commercial scale, have resulted in obtaining a quality of citrate of lime much above the average. Citric acid of exceptional purity and fine

Citrus By-Products Investigations—Continued.

appearance has been produced, but further work is necessary in order to secure a larger yield. The work on essential oils is about 50 per cent completed. New devices are being tried looking to the separation of the oil from the fruit before the fruit is crushed. Experiments have already demonstrated that this method of separation will result in a higher quality of oil.

Probable date of completion.—1918.
Assignment.—E. M. Chace, C. P. Wilson.
Proposed expenditures, 1915–16.—$10,720.

ENFORCEMENT OF THE FOOD AND DRUGS ACT.

[Regulation.]

ADMINISTRATION.

Collaboration with State Officials:

Object.—To secure collaboration with State food and drug officials in order to more efficiently enforce the food and drugs act.
Cooperation.—Food and drug officials of the various States.
Location.—Washington, D. C.
Date begun.—1907.
Assignment.—J. S. Abbott, H. S. Bailey.
Proposed expenditures, 1915–16.—$14,700.

Interstate and Import Records:

Object.—To keep accurate records of interstate and import cases under the food and drugs act.
Cooperation.—Solicitor of the department.
Location.—Washington, D. C.
Date begun.—1908.
Assignment.—H. J. Demaree, M. E. Hartman.
Proposed expenditures, 1915–16.—$18,500.

Preparation of Evidence for Cases:

Object.—To prepare evidence for presentation in cases under the food and drugs act and secure outside witnesses and experts in cases. This project also covers cost of travel to court.
Cooperation.—Solicitor of the department.
Location.—Washington, D. C.
Date begun.—1907.
Assignment.—I. K. Phelps.
Proposed expenditures, 1915–16.—$15,000.

Compilation of Information Regarding Food and Drug Products for Use in Enforcing the Food and Drugs Act:

Object.—For a number of years a mass of information has accumulated in the files of the Bureau of Chemistry, but is not accessible either for workers in the bureau or for workers on related subjects outside the bureau because it is not in available form. This material will be compiled for distribution to chiefs of inspection districts, chemists in charge of branch laboratories, and chemists of the Bureau of Chemistry, in the enforcement of the food and drugs act, and also to State and city chemists engaged in the enforcement of State and municipal laws concerning foods and drugs. Such parts of the material as may be considered of sufficient value will be prepared for publication.

Procedure.—The editorial work will be carried on by H. D. Gibbs, who will also compile information upon certain topics with which he is most familiar. Others in the bureau will assist in the compilation.

Location.—Washington, D. C.
Date begun.—1915.
Assignment.—H. D. Gibbs.
Proposed expenditures, 1915–16.—$3,000.

Total, Administration, $51,200.

FOOD CONTROL.

Preparation of Cases, Announcements, Standards, and Definitions:

Object.—To review cases, prepare correspondence, service and regulatory announcements, and advisory standards and definitions, make analyses and check analyses, and compile data for court cases in connection with the enforcement of the food and drugs act.

Procedure.—Cases are received from the inspection districts and recommendations made as to their disposition. Correspondence dealing with such cases and with labels and other food questions arising under the food and drugs act is prepared. Announcements of bureau rulings of general interest are prepared for publication for the information of the trade and the public. Check analyses of official samples are made by men specially experienced along certain lines. Data are compiled for use in court cases and for use in coming to decisions on questions arising under the act.

Location.—Washington, D. C.

Date begun.—1907.

Results.—Sixteen issues of the bureau publication "Service and Regulatory Announcements," including supplements, have been prepared for publication. Two hundred and one interstate, 18 import, and 77 miscellaneous samples of foods have been analyzed and reported. A monthly average of about 400 letters, exclusive of intrabureau memoranda and memoranda regarding cases, have been prepared. Approximately 2,500 interstate cases have been passed upon and appropriate recommendations prepared. Approximately 1,800 report cards on interstate food samples have also been reviewed and conclusions recorded.

Assignment.—H. M. Loomis, P. B. Dunbar.

Proposed expenditures, 1915–16.—$20,000.

Examination of Waters and Related Products:

Object.—To make analyses of interstate and import samples and samples from source, review cases, handle correspondence, complete data for court cases, etc.

Procedure.—Samples collected by inspectors of presumably misbranded or adulterated products are analyzed. The source of waters is inspected to determine the possibility of contamination or other adulteration.

Location.—Washington, D. C.

Date begun.—1907.

Results.—Numerous successful prosecutions of adulterated or misbranded products have been made. However, very general compliance with the law is being secured. The sanitary condition of waters sold in interstate commerce and imported from abroad is being carefully controlled, the general condition being satisfactory.

Assignment.—W. W. Skinner, J. W. Sale, W. F. Baughman, F. B. Furber.

Proposed expenditures, 1915–16.—$10,000.

Control of Stock Foods and Grains:

Object.—To make analyses of interstate and import samples, review cases, handle correspondence, complete data for court cases, etc.

Procedure.—Samples of cattle foods and grains offered for import and found in interstate commerce are collected and examined to determine whether they are in compliance with the provisions of the food and drugs act.

Cooperation.—Treasury Department and Department of Commerce; Solicitor of the department.

Location.—Washington, D. C.

Date begun.—1907.

Results.—General compliance with the law being obtained.

Assignment.—J. K. Haywood, G. L. Bidwell.

Proposed expenditures, 1915–16.—$9,000.

Preparation of Cases and Correspondence Relating to Carbohydrate Products:

Object.—To review cases, prepare correspondence, make check analyses of official samples, compile data for court cases, etc.

Procedure.—Cases concerning confectionery, sugars, sirups, jellies, jams, and preserves, and all cases relating to other food products in which a charge is made concerning a carbohydrate constituent are referred to

Preparation of Cases and Correspondence Relating to Carbohydrate Products—Continued.

this bureau for recommendation as to their disposition. Correspondence dealing with such cases and with labels and other food questions arising under the food and drugs act is prepared. Check analyses of official samples are made by men specially experienced along certain lines when necessary. Data for use in court cases and for use in coming to decisions on questions arising under the act are compiled.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Four import and two miscellaneous samples of foods have been analyzed and reported. An average of about 200 letters and memoranda a month, exclusive of memoranda regarding cases, have been prepared. Approximately 300 interstate cases have been passed upon and appropriate recommendations prepared. Approximately 525 report cards on interstate food samples have also been reviewed and conclusions recorded. Twenty-five drafts of notices of judgment have been reviewed for publication.

Assignment.—C. S. Hudson, M. N. Straughn, S. F. Sherwood, J. K. Dale. T. S. Harding.

Proposed expenditures, 1915–16.—$7,000.

Control of Dairy Products:

Object.—To make analyses of interstate and import samples, review cases, handle correspondence, complete data for court cases, etc.

Procedure.—Dairy samples are analyzed as submitted by inspectors and correspondence relating to this subject prepared. Cases relating to dairy products are considered.

Cooperation.—Dairy Division, Bureau of Animal Industry.

Location.—Washington, D. C.

Date begun.—1907.

Results.—General compliance with the law.

Assignment.—G. E. Patrick.

Proposed expenditures, 1915–16.—$8,000.

Microchemical Examination of Food and Drug Products:

Object.—To make analyses of interstate and import samples, review cases, handle correspondence, etc.

Procedure.—Samples are examined microscopically and such other work as needed in connection with cases performed.

Location.—Washington, D. C.

Date begun.—1907.

Results.—General compliance with the law.

Assignment.—B. J. Howard.

Proposed expenditures, 1915–16.—$7,600.

Milk Campaign:

Object.—To improve the quality of market milk entering interstate commerce.

Procedure.—The work will include the bacteriological examination of samples of milk, also inspection of farms, milk stations, and distributing houses, with suggestions for their improvement.

Cooperation.—Bureau of Animal Industry and local health authorities.

Location.—Temporary laboratories will be established in the regions to be benefited by the campaigns.

Date begun.—1907.

Results.—Improvement of the milk supply has been brought about by cooperation and education, and by prosecution when necessary.

Assignment.—Carleton Bates.

Proposed expenditures, 1915–16.—$5,000.

Microbiological Examination of Foods and Drugs:

Object.—To detect adulteration, contamination, and pollution.

Procedure.—Samples of foods and drugs are continually being examined and cases brought on those warranting such action. The analysts appear as witnesses when required.

Location.—Headquarters at Washington, D. C.; temporary laboratories in other cities.

Microbiological Examination of Foods and Drugs—Continued.

Results.—A large number of samples have been examined and prosecutions instituted in those cases where adulteration was revealed.

Assignment.—Carleton Bates.

Proposed expenditures, 1915–16.—$15,000.

Nitrogen Determinations:

Object.—To determine the nitrogen content of samples of various products when such determinations are necessary in the analysis of the various products.

Procedure.—Official analytical methods are employed in the determination of the nitrogen content of samples submitted by the other laboratories of this bureau and by other bureaus of the department.

Location.—Washington, D. C.

Date begun.—1901.

Results.—Fourteen thousand determinations have been made and reported.

Assignment.—T. C. Trescot.

Proposed expenditures, 1915–16.—$5,700.

Total, Food Control, $87,300.

DRUG CONTROL.

Expert Review of Analyses and Recommendations on Drug Samples:

Object.—To review and pass upon drug cases.

Procedure.—The analytical findings and recommendations of inspection districts in connection with evidence presented at hearings are critically reviewed.

Location.—Washington, D. C.

Date begun.—1907.

Results.—Gradual improvement has resulted in the quality of crude and manufactured drugs and in the labeling of proprietary preparations.

Assignment.—L. F. Kebler, W. O. Emery, E. K. Nelson, A. G. Murray, F. P. Morgan.

Proposed expenditures, 1915–16.—$7,500.

Drug Analyses:

Object.—To conduct analyses of interstate and import drugs and drug products to determine if same are in compliance with the food and drugs act.

Procedure.—Established methods will be employed where available; otherwise newly developed methods will be used.

Location.—Washington, D. C.

Date begun.—1907.

Results.—The results of these analyses have been used as a basis for action in the enforcement of the food and drugs act and also, in cooperation with other departments, in the enforcement of various other laws.

Assignment.—L. F. Kebler, W. O. Emery, E. K. Nelson, A. G. Murray, E. C. Merrill.

Proposed expenditures, 1915–16.—$20,000.

Examination of Turpentine and Rosin:

Object.—To examine turpentine and rosin samples to determine whether or not they are adulterated; to check analyses and pass upon cases on turpentine and rosin under the food and drugs act.

Location.—Washington, D. C.

Date begun.—1906.

Assignment.—F. P. Veitch, H. P. Holman.

Proposed expenditures, 1915–16.—$512.

Crude-Drug Control:

Object.—To inspect imported drugs arriving at ports where drug-inspection facilities are limited; to check important work on import and interstate cases; to prepare standards and collect data, with the object in view of securing uniformity in drug inspection.

Procedure.—The usual methods of pharmacognostic investigations are followed.

Location.—Washington, D. C.

Crude-Drug Control—Continued.
Date begun.—1914.
Results.—Considerable work on crude drugs has been completed. Data have been collected for the guidance of the administrative offices in enforcing the food and drugs act in its application to crude drugs.
Assignment.—A. Viehoever, C. O. Ewing.
Proposed expenditures, 1915–16.—$6,200.

Total, Drug Control, $34,212.

FIELD FOOD AND DRUG INSPECTION.

Inspection Work:
Object.—To collect samples, inspect factories, and secure data bearing on food and drug industries.
Cooperation.—State food and drug inspectors and Bureau of Animal Industry inspectors.
Location.—District headquarters at Washington, D. C., Chicago, Ill., and San Francisco, Cal. Inspectors travel over the whole United States.
Date begun.—1907.
Results.—A large number of samples collected, factories inspected, and data assembled.
Assignment.—W. G. Campbell, L. M. Tolman, B. R. Hart.
Proposed expenditures, 1915–16.—$125,000.

Hearings and Correspondence:
Object.—To hold hearings, conduct correspondence, and prepare cases at district headquarters and at branch laboratories in connection with the enforcement of the food and drugs act as applied to both interstate and import business.
Location.—District headquarters at Washington, D. C., Chicago, Ill., San Francisco, Cal., and at branch laboratories.
Date begun.—1907.
Assignment.—W. G. Campbell, L. M. Tolman, B. R. Hart.
Proposed expenditures, 1915–16.—Included in cost of laboratories listed below.

Examination of Samples:
Object.—To make chemical and other analyses of samples of foods and drugs to determine whether or not they are adulterated or misbranded.
Location.—District headquarters and branch laboratories of Bureau of Chemistry.
Date begun.—1907.
Assignment.—W. G. Campbell, L. M. Tolman, B. R. Hart.
Proposed expenditures, 1915–16.—Included in cost of laboratories listed below.

Insecticide Work:
Object.—To hold and report hearings, collect samples of both interstate and import shipments, and conduct other routine work in connection with the enforcement of the insecticide act.
Cooperation.—Insecticide and Fungicide Board.
Location.—District headquarters and branch laboratories.
Date begun.—1910.
Assignment.—W. G. Campbell, L. M. Tolman, B. R. Hart.
Proposed expenditures, 1915–16.—Included in cost of laboratories listed below.

Regulatory Investigations:
Object.—To develop methods of analysis, detect and study new adulterants, secure data on trade practices, and study food and drug industries, in order to properly enforce the food and drugs act.
Location.—District headquarters and branch laboratories.
Date begun.—1907.
Assignment.—W. G. Campbell, L. M. Tolman, B. R. Hart.
Proposed expenditures, 1915–16.—Included in cost of laboratories listed below.

BRANCH FOOD AND DRUG LABORATORIES.

Location.	Assignment.	Proposed expenditures, 1915-16
Eastern district; headquarters, Washington, D. C.	W. G. Campbell, chief of district	....
Washington, D. C	Vacant	$30,000
New York, N. Y	R. E. Doolittle	76,000
Boston, Mass	A. L. Sullivan	20,000
Philadelphia, Pa	C. S. Brinton	11,000
Buffalo, N. Y	L. Patton	7,000
Savannah, Ga	W. J. McGee	8,500
San Juan, P. R	E. H. Grant	5,500
Central district; headquarters, Chicago, Ill	L. M. Tolman, chief of district	....
Chicago, Ill	Geo. W. Hoover	58,000
St. Paul, Minn	E. H. Goodnow	9,400
St. Louis, Mo	D. B. Bisbee	9,000
Cincinnati, Ohio	L. B. Forst	11,000
New Orleans, La	F. W. Liepsner	8,000
Western district; headquarters, San Francisco, Cal	B. R. Hart, chief of district	....
San Francisco, Cal	R. W. Hilts	27,000
Seattle, Wash	A. L. Knisely	11,000
Denver, Colo	R. S. Hiltner	15,000
Honolulu, Hawaii	A. W. Hansen	4,000
		310,400

Total, Field Food and Drug Inspection, $435,400.

[Research.]

FOOD INVESTIGATIONS.

Studies on the Analysis and Composition of Vinegars:

Object.—To develop methods of analysis and to acquire knowledge of the composition of vinegars.

Procedure.—This work involves an investigation of methods of analysis of vinegars in general and the application of these methods to the determination of the composition of authentic samples of the different vinegars—for the present more particularly of those made from sugar or molasses and from corn-starch sugar, the work to extend also to spirit, wine, malt, and cider vinegars.

Cooperation.—Vinegar manufacturers.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Existing methods of analysis have to some extent been brought together, compared, and systematized. Instruction in methods of vinegar analysis has been given to 11 men destined for the field or other service of the bureau. An investigation on the composition of cider vinegar made from two lots of mixed apples grown in Virginia has been completed and is about to be reported to the chief of the bureau. Work on the isolation of glycerin in cider vinegar and on the identification of the volatile reducing substances occurring in cider vinegar and some other vinegars is well under way.

Assignment.—R. W. Balcom.

Proposed expenditures, 1915–16.—$6,500.

Study of the Composition of American Oils and Fats:

Object.—To determine the composition of oils and fats used in foods, in order to obtain data for standards; to improve methods of analysis and to determine adulterants therein.

Procedure.—Methods for the analysis of oils and fats are investigated and the most desirable methods applied to the analysis of authentic samples of American oils and fats.

Cooperation.—Manufacturers and refiners.

Location.—Washington, D. C.

Study of the Composition of American Oils and Fats—Continued.

Date begun.—1914.

Results.—Official methods have been thoroughly investigated and, wherever possible, applied to the analysis of the material collected. New methods appearing in the literature have been tried and in some cases adopted, and changes in old methods, where such seemed necessary, have been worked out. Authentic samples of cocoa butter and substitutes, tomato-seed oils, and charlock oils have been collected and analyzed, and the results are in process of publication. Samples of cottonseed oils have been collected for two years, and data upon them are available, but will not be published for another year.

Assignment.—H. S. Bailey.

Proposed expenditures, 1915–16.—$3,000.

Studies of Methods for the Determination of Heavy Metals in Foods:

Object.—To develop standard and more accurate analytical methods for the determination of heavy metals in foods.

Procedure.—The work will probably be taken up in the following order: Lead in baking powder, baking chemicals, acid phosphate, and canned goods; zinc in gelatin and in dried fruit; tin in canned goods; arsenic in baking powder, baking chemicals, acid phosphate, and gelatin. The usual laboratory methods for developing methods of analysis will be followed.

Cooperation.—Officials and members of the Association of Official Agricultural Chemists, and food manufacturers.

Location.—Washington, D. C.

Results.—Active work on this project was not begun until January 16, 1915. Methods for the determination of lead, arsenic, and tin are now being studied.

Assignment.—W. D. Collins, E. L. P. Treuthardt.

Proposed expenditures, 1915–16.—$5,000.

Studies in the Chemistry of Essential Oils and Synthetic Flavors and Flavoring Extracts:

Object.—To devise or extend selected methods of analysis and secure data as a basis for standards.

Procedure.—A method for the determination of esters in the analysis of citrus oils will be elaborated and, if practicable, applied to the corresponding extracts. An attempt will be made to devise a chemical method for distinguishing synthetic from natural oil of wintergreen. The behavior of some essential oils and the constituents thereof on hydrogenation will be studied. The analysis of some synthetic flavors will be studied.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1917.

Assignment.—A. R. Albright.

Proposed expenditures, 1915–16.—$3,000.

Investigation of the Effect of Hydrogenation upon Oils Intended for Use as Food Products:

Object.—To determine the nature of the changes taking place in various oils during the process of hydrogenation, with special relation (*a*) to the change in the analytical constants and (*b*) to the production of isomeric glycerids of the fatty acids under different known conditions; and to prepare for use in nutrition investigations hardened oils of known history, in order to secure information to guide action in the enforcement of the food and drugs act. Little is on record on this subject at present.

Procedure.—Authentic oils will be hydrogenated under known and as nearly as possible commercial conditions. Samples will be analyzed from time to time throughout the entire process. The exact chemical composition of the original and resulting products will be determined.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1917.

Assignment.—H. S. Bailey.

Proposed expenditures, 1915–16.—$2,500.

Investigation of the Sweating of Citrus Fruits:

Object.—To investigate the methods in vogue for accelerating the coloring of green citrus fruits; and to ascertain the effect of this so-called "sweating" upon the composition, flavor, and the keeping and shipping qualities of the fruit.

Cooperation.—Bureau of Plant Industry. Samples of the fruit used under careful handling experiments are desired, in order to obtain analyses before and after sweating, storage, and shipment. The results, so far as keeping and shipping qualities are concerned, are to be taken care of by the Bureau of Plant Industry; effects upon the composition, by the Bureau of Chemistry.

Location.—Los Angeles and Portersville, Cal., and such other locations as may seem desirable.

Date begun—1914.

Results.—Preliminary work was inaugurated last fall, and a study of the atmosphere contained in sweat rooms was made and the effect of the gases found therein upon green fruit tried on a laboratory scale. A few analyses were made before and after sweating and after storage. The results indicated that there was in all probability a material change in the composition of sweated fruit.

Probable date of completion.—1916.

Assignment.—E. M. Chace, C. G. Church.

Proposed expenditures, 1915–16.—$1,500.

Study of the Composition of California Oranges:

Object.—To ascertain the composition of California oranges, with a view to establishing, if possible, a definite standard of maturity; to ascertain the effect of storage at various stages of maturity upon composition; to investigate the composition of fruit in localities where past results have indicated the probability of abnormal composition.

Procedure.—Trees are located in different sections of the citrus-producing regions of California, upon different types of soil and at different altitudes. Samples are taken from these trees at stated periods, usually once each week, and the analyses made immediately. Where samples can not be collected by the laboratory force, they are mailed by the grower or packing-house agent to the laboratory. Fruit at different stages of maturity is placed in storage and samples from each lot analyzed at weekly intervals. Data concerning methods of cultivation, irrigation, fertilization, and grove management are collected upon the groves from which samples are taken, in order that abnormalities occurring may possibly be accounted for.

Cooperation.—Various growers and associations throughout California.

Location.—A laboratory at Los Angeles, Cal., during the whole year; at Portersville, Tulare County, Cal., from October 1 to January 1; samples from the entire citrus region of California.

Date begun.—1913.

Results.—As a result of the first year's work, the bureau gave out a statement suggesting a tentative basis of maturity. This figure was adopted by the growers of Tulare County, who lived up to its restrictions during the whole of the 1914 and 1915 season, with results that were highly satisfactory to all concerned during a year which has been considerably below the average for California prices. The fruit shipped under this standard has everywhere brought about an increased demand for Tulare County fruit. But one paper has been published, that being read before the State food and drug officials at Portland, Me., last year upon "The Sweating of Oranges." Practically 2,000 analyses have been completed and will be offered for publication as soon as the state of the work makes it advisable. Whether further definition of maturity shall be made this year has not been decided.

Probable date of completion.—July 31, 1916.

Assignment.—E. M. Chace, C. G. Church.

Proposed expenditures, 1915–16.—$5,000.

Study of Experimental Packs of Canned Goods:

Object.—To collect information on tin content, acids, net weight, proper fill, and presence of added water in connection with canned foods; to determine the effect of storage and the effect of coatings upon canned goods; and to study the relation of grading to quality.

Study of Experimental Packs of Canned Goods—Continued.

Procedure.—This work is carried out largely by visiting commercial canneries preparing canned goods under known conditions and of known quality. A determination of the effect of the contents on the tin coating is made at intervals. A study of the maximum fill of cans possible with different varieties of fruit which will still permit of the proper processing and sealing is made. In certain canned foods the addition of water is considered an adulteration, and it is necessary to devise methods for the detection of small amounts of added water in such canned foods. During the coming season it is planned to put up experimental packs of peas and beans for examination as to quality and fill of can and to devise methods for detecting soaked products.

Cooperation.—Commissary General, United States Army, field inspection force, and commercial canneries.

Location.—Washington, D. C.

Date begun.—1909.

Results.—One hundred and seven samples of the National Canners' Association experimental packs were analyzed, involving 343 determinations, and reports made to the Commissary General, United States Army, in December, 1914; 12 samples of canned beans and peas representing various commercial sizes and qualities analyzed in detail in connection with the Bureau of Chemistry's exhibit at the Panama-Pacific Exposition at San Francisco; complete analyses of 18 samples of canned tomatoes and tomato juice packed under the bureau's supervision made, with a view to the detection of added water. Results of the determinations have been used in adopting analytical constants for the detection of added water in tomatoes. The final examination of the experimental pack of oysters, consisting of 64 samples, with a view to determining the proper fill of cans under Food Inspection Decision 144, has been made. The effects of storage on canned oysters have also been noted. These oysters were packed in commercial canneries, with varying amounts in the different size cans used by the trade. Weights of drained solids and liquor were determined. A similar final examination was made on the experimental pack of canned clams represented by 34 samples. The examination was similar to that made in the case of the oyster pack. Analyses of experimental packs of canned goods were made in 1910 to 1913, inclusive. These results have been tabulated and are being arranged with a view to publication. The pack consists of 170 samples, representing 30 different substances, packed in various grades of tin plate with and without lacquer. The information from this work is of value in connection with Food Inspection Decision 126.

Probable date of completion.—1920.

Assignment.—E. L. P. Treuthardt.

Proposed expenditures, 1915–16.—$1,200.

Investigation of Canning Processes and Canning Methods:

Object.—To ascertain the effect of blanching and storage before canning and of other factors upon the composition of canned foods; also to study filling machines.

Procedure.—Food products stored and canned under various known conditions will be collected and examined, with a view to determining the effect of such conditions on the finished product. This work will be carried on to some extent at commercial canneries, and a study of filling machines will also be made. During the coming season it is planned to make an investigation on the use of cornstarch in packing canned corn. According to the Maine packers' statement, it is impossible to can corn which has not fully developed, on account of a short season, without the use of a small amount of cornstarch.

Cooperation.—Commercial packing houses.

Location.—Washington, D. C.

Date begun.—1909.

Results.—Twenty-two samples of Italian tomato paste collected by an expert of this bureau in Italy were completely analyzed, with a view to detecting spoilage and excessive dirt. Seven samples of blighted and unblighted tomatoes were collected and canned at Havre de Grace, Md., by bureau representatives. Complete analyses of these samples before

Investigation of Canning Processes and Canning Methods—Continued.

and after canning were made, and these results are of value in helping to distinguish watered from blighted tomatoes.

Probable date of completion.—1917.

Assignment.—H. M. Loomis.

Proposed expenditures, 1915–16.—$1,200.

Commercial Egg Denaturing:

Object.—(1) To denature unsound eggs to make them unusable for food purposes and (2) to utilize such denatured material for industrial purposes.

Procedure.—Numerous denaturants have been tried in the laboratory, baking experiments have been made to show the effectiveness of selected denaturants, and industrial-scale experiments are being conducted in denaturing and demonstrating the industrial use of the denatured material.

Cooperation.—Egg dealers, bakers, and industrial establishments.

Location.—Washington, D. C.; New York and Gloversville, N. Y.; Peabody and Salem, Mass.; and Hoboken, N. J.

Date begun.—1914.

Results.—Denaturants satisfactory in laboratory work have been found. These are now being tried industrially.

Probable date of completion.—1916.

Assignment.—J. S. Rogers.

Proposed expenditures, 1915–16.—$800.

Study of Methods of Producing Egg Oil from "Off Grade" Eggs:

Object.—To devise a cheap and efficient means for the separation of the oil and leather-tanning constituents from this class of eggs; and to encourage the use of this oil in the leather-tanning industry, thereby affording a ready and suitable market for eggs of a quality unsuitable for food purposes.

Procedure.—A field laboratory will be established at some point in the egg-breaking centers to work out methods and their application to the separation of oil and lecithin from waste eggs.

Cooperation.—Egg-breaking firms and tanneries.

Location.—Headquarters, Washington, D. C.

Date begun.—1913.

Results.—Preliminary work under way.

Probable date of completion.—1917.

Assignment.—F. C. Weber, H. W. Houghton.

Proposed expenditures, 1915–16.—$1,000.

Sardine Investigations:

Object.—(1) To collect information and data in regard to the sardine industry; (2) to study the sanitary and hygienic aspects of the methods employed in packing; (3) to collect chemical and bacteriological data which will assist in the enforcement of the food and drugs act; (4) to study the question of "red feed" in its relation to decomposition and quality of raw material; (5) to note kind, quality, and quantity, and to make study of the waste products; and (6) to obtain data for establishing tolerances in net weight.

Procedure.—A chemical and bacteriological laboratory has been established at Eastport, Me. Further work planned: (1) To prepare a sufficient quantity of fish-meat meal from the waste to determine, in cooperation with the Bureau of Animal Industry, the feeding value of the waste, as prepared in work so far, as an animal food; (2) to pack and introduce a higher grade product; and (3) to design and introduce mechanical devices for separating the fish into sizes, and to cut and eviscerate them.

Cooperation.—Various companies composing the industry.

Location.—Eastport, Me., and Washington, D. C.

Date begun.—1913.

Results.—A very satisfactory cooperative spirit developed; lack of attention to ordinary methods of cleanliness found to be the greatest factor responsible for the production of a low-grade article; bacteriological growth shown not to be an important factor in the sanitary and hygienic conditions. Circular letters were sent out to all the individual companies in the industry calling attention to the sanitary and hygienic conditions and

Sardine Investigations—Continued.

making suggestions for their improvement, and also suggesting improved ways, in certain instances, to handle and pack the fish. During the season of 1914 remarkable improvements as a whole were made as a result of these suggestions. Many of the canneries were put in first-class condition, and more attention was given to the matter of handling and packing the fish. The net result of this alone produced an estimated improvement of 33 per cent in the quality of the 1914 season's pack. Corn oil has been found to be a satisfactory substitute for cottonseed oil in the packing of sardines and has been recommended to the industry. Waste in the industry has been found to be very large. The following methods of utilization have been studied and advocated: Use of a longer can to fit the larger fish, rather than cutting away a large part of the fish to fit a small can; preparation of sardine paste and deviled sardines, kippered herring, "herring chunks" and Bismarck herring, and fish-meat meal (as a stock food).

Probable date of completion.—Fall of 1915.
Assignment.—F. C. Weber, H. W. Houghton.
Proposed expenditures, 1915–16.—$4,210.

Study of Wheat and Wheat Flour with Reference to the Effects of the Commercial Bleaching Processes:

Object.—To procure data for the enforcement of the food and drugs act by the study of effects of aging and bleaching processes on the properties of flour as evidenced by the products (bread, etc.) made from flour; to study chemical processes to detect bleaching, etc.

Procedure.—Studies of flours of various ages, kinds, and grades, both unbleached and bleached, when made into bread, etc., under domestic, laboratory, and commercial conditions.

Cooperation.—Flour warehousemen, millers, and bakers.
Location.—Washington, D. C.
Date begun.—1915.
Probable date of completion.—1917.
Assignment.—I. K. Phelps.
Proposed expenditures, 1915–16.—$15,000.

Investigation of the Manufacture and Composition of Sauerkraut:

Object.—To determine the normal composition of pure kraut, the proper fill of canned kraut, the use of pure cultures in its manufacture, and utilization of waste products.

Procedure.—The project has been started by the assistant who has visited kraut factories in Baltimore, Md., and collected samples prepared under known conditions. The examination of these samples is now under way. Data collected and obtained in connection with samples will include information as to the raw materials used, the time and temperature of fermentation, method of processing, the fill of the cans, including the amount of brine or salt used, and the determination of solids, sugars, acid, crude fiber, and ash in the canned product, with further determinations if they appear necessary. Next fall it is planned to make a more extended trip through the kraut factories and to study methods of fermentation, including the use of pure cultures, and the utilization of waste products.

Cooperation.—Manufacturers.
Location.—Washington, D. C., and kraut manufacturers of New York, Pennsylvania, and Maryland.
Date begun.—1915.
Probable date of completion.—1916.
Assignment.—C. Thom, S. Coopersmith.
Proposed expenditures, 1915–16.—$1,000.

Study of Poisonous Elements on Fruits and Vegetables Sprayed with Poisonous Sprays:

Object.—To determine what quantity of poisonous elements remain on fruits and vegetables sprayed with poisonous sprays; to ascertain whether such poisonous elements can be removed by the consumer; to learn how to determine the quantity of poisonous elements that may be present by reason of the excessive use of sprays; and to determine whether changes can be made in time and method of spraying by which danger from injurious metals may be lessened.

Study of Poisonous Elements on Fruits and Vegetables Sprayed with Poisonous Sprays—Continued.

Procedure.—It is planned to spray various kinds of fruit trees and vegetables according to the accepted schedules and to study the composition of the fruits as they reach the consumer; to treat the fruits and vegetables in various ways to see if poisonous metals can be removed; to spray with excessive amounts of sprays to determine how much of the injurious metals may be present under adverse conditions; and to study methods of so changing the usually accepted spraying schedules as to lessen or eliminate danger from the poisonous elements. This work will be carried out probably at the Arlington Farm and in orchards in various localities.

Cooperation.—It is planned to make this a cooperative study by the Bureaus of Chemistry, Plant Industry, and Entomology. It is possible that some of the State experiment stations will also be asked to aid in the work by spraying lots of trees in accordance with definite instructions and sending the fruit to Washington for examination.

Location.—Washington, D. C.; Arlington, Va.; and orchards in various sections of the United States.

Date begun.—1915.

Probable date of completion.—1917.

Assignment.—W. D. Lynch, J. K. Haywood, C. C. McDonnell.

Proposed expenditures, 1915–16.—$3,500.

Investigation of Color and Color Substances, with Special Reference to Food and Drug Products:

Object.—To investigate the formation, methods for detection, isolation, comparison, and determination of the structure of colors and color substances, both natural and artificial, occurring in or used in food and drug products.

Procedure.—Primarily it will be necessary to obtain or manufacture various pure substances, largely of an organic nature. These compounds will be prepared from plants or plant products or will be synthesized. These compounds will be investigated through a study of their chemical and physical properties.

Location.—Washington, D. C., and bureau field laboratories.

Date begun.—1915.

Probable date of completion.—1919.

Assignment.—H. D. Gibbs.

Proposed expenditures, 1915–16.—$6,000.

Study of Vanilla and Tonka Beans and Their Extracts:

Object.—To determine the composition of the beans, of the extracts, and of waste products arising from different methods of manufacture.

Procedure.—It is planned to visit importers and obtain authentic samples of beans, in order to detect washed beans if possible. Manufacturers of extracts will be asked to furnish samples and permit a study of their methods of manufacture. The results obtained on these extracts will be compared with extracts prepared by a standard laboratory method. and also by similar methods conducted on a laboratory scale.

Cooperation.—Importers of beans and manufacturers of extracts.

Location.—Washington, D. C., and field.

Date begun.—1915.

Probable date of completion.—1917.

Assignment.—C. O. Dodge.

Proposed expenditures, 1915–16.—$700.

Investigation of Enameled Cooking Utensils:

Object.—To determine the composition of the various forms of enamel used on cooking utensils and their solubility in different food products or ingredients.

Procedure.—Samples of enameled wares of various makes will be purchased and the enamel analyzed. Cooking experiments with a variety of food products or ingredients will then be carried out to determine the solvent action on the different types of enamel.

Location.—Washington, D. C.

Date begun.—1915.

Investigation of Enameled Cooking Utensils—Continued.

Results.—A preliminary study has been made of the composition of 25 samples of enameled wares.

Probable date of completion.—1917.

Assignment.—H. M. Loomis, C. O. Dodge.

Proposed expenditures, 1915–16.—$1,000.

Investigation of Methods of Analysis for Fruit Products:

Object.—To develop methods of analysis and determine the characteristic components of various fruits.

Procedure.—The application of various methods for the determination of organic acids of fruits and fruit products will be studied.

Cooperation.—Collaborators from the Association of Official Agricultural Chemists.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1917.

Assignment.—P. B. Dunbar, H. A. Lepper.

Proposed expenditures, 1915–16.—$750.

Study of Green and Roasted Coffee:

Object.—(1) To secure data as to the changes taking place on roasting coffee, (2) to secure information on moisture content of green and roasted coffee and changes in moisture on storage, (3) to study the glazing or coating of coffee in connection with the enforcement of the food and drugs act, and (4) to study the commercial grades of coffee and secure data for establishing a standard for coffee to be imported.

Procedure.—The project leader has already made trips to New York City and Baltimore, Md., to ascertain commercial practices in grading and roasting coffee and has secured samples of a number of green coffees and the same after roasting. These are now being analyzed. Preliminary reports have been submitted on the coating and grading of coffee. Through the State Department the consuls in Brazil have been requested to secure authentic samples of coffee as they come from the plantations, in order to secure information on how the natural product runs. These samples will probably arrive during the coming summer and fall and will be examined for black and spoiled beans, overripe, shriveled, and immature beans, and for bean shells and foreign matter. Further work is contemplated on roasted coffee, in order to establish a maximum limit for moisture and to prevent excess coating or drenching with water.

Cooperation.—State Department and manufacturers.

Location.—Washington, D. C.; New York, Maryland, Pennsylvania, Missouri, and Louisiana.

Date begun.—1915.

Results.—Samples of green coffees have been obtained and are now being analyzed. Preliminary reports have been submitted on coating and grading of coffees.

Probable date of completion.—1917.

Assignment.—H. M. Loomis, A. Viehoever.

Proposed expenditures, 1915–16.—$1,000.

Total, Food Investigations, $63,860.

PHYSICOCHEMICAL INVESTIGATIONS.

Physicochemistry and Engineering of Carbonation:

Object.—To determine the physical and chemical characteristics of carbonated liquids; to ascertain the machinery processes which produce given carbonation effects.

Procedure.—Experimental study of carbonated liquids made under known laboratory conditions and of carbonated liquids sold in trade, supplemented by factory study.

Location.—Washington, D. C.

Date begun.—1913.

Results.—An efficient carbonation machine has been developed for impregnating liquid with gas directly in the glass bottle. This machine also permits one to study the rate of gas evolution, etc., and systematic work

Physicochemistry and Engineering of Carbonation—Continued.

with it is now in progress. A number of carbonated liquids, both natural and artificial, have been studied. These results have been used in the regulation of imports and domestic commerce in foaming wines, cider, etc. The results also bear upon the use of distilled water in carbonated nonalcoholic drinks.

Assignment.—H. E. Patten.

Proposed expenditures, 1915–16.—$2,069.

Electrochemical Study of Reactions in Vegetable, Fruit, and Animal Juices:

Object.—To make an electrochemical study of reactions in vegetable, fruit, and animal juices, involving an evolution of the so-called hydrogen and hydrogen-ion concentration; to secure a better understanding of the causes of corrosion of metallic containers; to secure a better understanding of jell formation; and to obtain better preservation of food products.

Procedure.—Assembling of necessary physical and electrical and chemical apparatus of a fixed nature to carry out electromotive force determinations and electrical conductivity determinations under controlled conditions.

Location.—Washington, D. C.

Date begun.—1913.

Results.—An air thermostat has been installed for control of temperature to 0.01 of a degree, and hydrogen-electrode cells have been set in place and connected with a delicate potentiometer. A large water thermostat for use with the electrochemical conductivity set and for solubility determinations is nearly completed.

Assignment.—H. E. Patten.

Proposed expenditures, 1915–16.—$1,744.

Physical Chemical Study of the Reactions in Vegetable, Fruit, and Animal Juices:

Object.—To determine what effect the concentration of individual chemical substances in plant and animal juices has on the keeping qualities of food products, and also to determine the chemical conditions which induce jell formation.

Procedure.—The concentration of individual chemical substances in plant and animal juices in their relation to the neutral point between acidity and alkalinity will be determined. The conditions of jell formation and the colloid chemistry involved—more especially the concentrations of alkali or of acid at which the disperse phase aggregates into the jell condition—will be studied.

Location.—Washington, D. C.

Date begun.—1913.

Results.—Thus far apparatus and material have been collected and considerable library work done.

Assignment.—H. E. Patten.

Proposed expenditures, 1915–16.—$1,569.

Chemistry and Manufacture of Baking Powders:

Object.—To determine the effect of the ingredients of baking powders upon the rate and quantity of gas evolved and upon the concentration in the residual solids and liquids, and, in the biscuits, of these ingredients or their reaction products.

Procedure.—A synthetic study of the effect of calcium sulphate in baking powders is in progress; also a study of the determination of lead in baking powders, and a study of the effect of acidity of so-called baking acids.

Location.—Washington, D. C.

Date begun.—1911.

Results.—The calcium sulphate is found not to be an inert material, but when present in small quantity assists the phosphoric acid in exerting its full acidity.

Assignment.—H. E. Patten.

Proposed expenditures, 1915–16.—$1,619.

Total, Physicochemical Investigations, $7,001.

MICROBIOLOGICAL INVESTIGATIONS.

Bacteriological Analyses of Foods and Drugs:

Object.—To develop bacteriological standards of foods and drugs. This makes possible the assignment of research workers to the development of standards and methods for handling products as yet insufficiently known to be handled by routine methods.

Procedure.—Laboratory and field investigation of the products with systematic cultural work under known conditions.

Location.—Washington, D. C.

Date begun.—1907.

Results.—Papers are submitted covering each separate piece of investigation. In the past year such papers have covered the preservation of eggs and the commercial cultures for souring milk.

Assignment.—Charles Thom.

Proposed expenditures, 1915–16.—$8,000.

Cultural Studies of Penicillium and Aspergillus and Species of Related Genera:

Object.—To identify species of these genera and to study their morphology and physiology and their distribution in nature, with a view to determining which of these species are active in the spoilage of foodstuffs.

Procedure.—Cultures of these organisms from any source are made, especially where found to be factors in the decomposition or fermentation of food and drugs. Comparative studies are made of species and of their physiological activities in their natural substrata.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Papers are published from time to time as groups of species are worked out.

Assignment.—Charles Thom.

Proposed expenditures, 1915–16.—$1,000.

Mycology of Spoilage in Cereal Products:

Object.—To determine the cause of deterioration in food products, such as corn meal or flour, with special reference to the part played by microorganisms in such spoilage.

Procedure.—Cultures are obtained from such products in varying stages of deterioration as the basis for identifying significant species. These are inoculated into cereals for further study.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Preliminary studies have been made with corn meal.

Probable date of completion.—1917.

Assignment.—Charles Thom.

Proposed expenditures, 1915–16.—$1,000.

Biological Factors in the Deterioration of Forage and Feeding Stuffs:

Object.—Isolation and identification of organisms found in relation to the specific forms of spoilage of the food of domestic animals and the determination of the conditions favorable to the activities of such species.

Procedure.—Cultures are made from feed in various stages of decomposition. The organisms are isolated, compared, and described, and pure-culture inoculations made for the purpose of studying their relation to decomposition processes.

Cooperation.—Pathological Division of the Bureau of Animal Industry. That division studies the relation of such feeding stuffs to animal health and nutrition.

Location.—Washington, D. C.

Date begun.—1913.

Results.—The work has been limited to an examination of materials arising in connection with the disease of horses known as "forage poisoning." In the winter of 1914–15 the occurrence of cases of this disease in connection with corn silage furnished the material for an investigation of the biology of spoilage in corn silage.

Assignment.—Charles Thom.

Proposed expenditures, 1915–16.—$1,000.

Classification of the Bacteria Occurring in Food Products:

Object.—To identify the organisms found in connection with the inspection of food products, as a means of obtaining a sound foundation for studying their effects.

Procedure.—Laboratory methods will be followed in the study and comparison of the microorganisms.

Location.—Washington, D. C.

Date begun.—1915.

Assignment.—Charles Thom.

Proposed expenditures, 1915–16.—$1,000.

Toxicity of Rhizopus and Other Mucorineæ as a Factor in Food Spoilage and Intoxication by Spoiled Food:

Object.—To obtain information in regard to the effect of spoilage of food.

Procedure.—Pure mold cultures will be grown in large quantity and studied chemically and examined pharmacologically. An attempt will be made to isolate and identify the toxic substance produced by the growing mold, also to determine the proper conditions of the nutrient and the length of growing time to produce maximum toxicity.

Cooperation.—Carnegie Institute of Washington at Cold Spring Harbor, N. Y.

Location.—Cold Spring Harbor, N. Y. (mold growing); Washington, D. C. (chemical and pharmacological work).

Date begun.—1915.

Results.—Apparatus has been installed and technique developed for the production of large quantities of mold filaments; first shipment of powdered filaments, 200 grams, received at Washington May 6, 1915.

Probable date of completion.—June 30, 1916.

Assignment.—A. F. Blakeslee and R. F. Schulze (Cold Spring Harbor, N. Y.); J. F. Brewster (Washington, D. C.).

Proposed expenditures, 1915–16.—$1,800.

Soaking of Oysters:

Object.—To determine the extent to which oysters may be legitimately washed or chilled before marketing.

Procedure.—Control experiments under commercial conditions are conducted in cooperation with various firms engaged in the oyster trade.

Cooperation.—Individuals, firms, and State commissions engaged in the study or handling of oysters.

Location.—Bureau field laboratories established for the sanitary inspection of oyster beds.

Date begun.—1914.

Results.—Prosecution of dealers willfully soaking shucked oysters.

Assignment.—Carleton Bates.

Proposed expenditures, 1915–16.—$1,000.

Study of Swelled Canned Foods:

Object.—To determine the types of microorganisms present and the gaseous products of their growth responsible for the spoilage of and "swells" in canned food products, as an aid in the differentiation of the various forms of spoilage.

Procedure.—Spoiled canned foods will be collected and determinations made of organisms and gases found in them. From information thus gathered spoiled canned products will be prepared and the gaseous products formed in the cans under these known conditions determined.

Location.—Washington, D. C.

Date begun.—1915.

Assignment.—Charles Thom, F. C. Weber.

Proposed expenditures, 1915–16.—$1,000.

Total, Microbiological Investigations, $15,800.

MICROCHEMICAL INVESTIGATIONS.

Microanalysis of Foods and Drugs:

Object.—To develop microscopical methods of analysis of food and drug products.

Procedure.—Field or laboratory methods are employed as each case demands.

Microanalysis of Foods and Drugs—Continued.

Location.—Headquarters, Washington, D. C.

Date begun.—1901.

Results.—Studies on some lines are completed. During the past year special results have been obtained in the study of natural and artificial color in pearl barley; methods of estimation of cacao shells in cocoa and chocolate products; method of estimation of ergot in rye flour.

Assignment.—B. J. Howard.

Proposed expenditures, 1915–16.—$3,000.

Studies in the Microscopical Detection of Decomposition in Tomato Products:

Object.—To determine the influence of certain processes of manufacture upon the microscopical characteristics of the product, especial attention to be given to the question of (*a*) the influence on the "finishing" process upon the microscopical count and (*b*) the correlation between the amount of decay in tomatoes and the microscopic count of microorganisms on the finished product.

Procedure.—Studies will be made under factory conditions of samples of tomatoes before pulping and also microscopical studies of the pulp and finished product.

Cooperation.—Tomato-canning establishments.

Location.—Headquarters, Washington, D. C.; various canneries, especially in Maryland.

Date begun.—1908.

Results.—A better understanding of the causes of high counts of microorganisms in certain products; the collection of data bearing on the subject.

Assignment.—B. J. Howard, Charles H. Stephenson.

Proposed expenditures, 1915–16.—$540.

Total, Microchemical Investigations, $3,540.

WATER INVESTIGATIONS.

Study of the Methods of Water Analysis:

Object.—To devise new methods in water analysis, to improve old methods and unify them, to develop methods for accurately measuring radioactivity, to study the radioactivity of waters, and to study the content of the rarer constituents of waters.

Procedure.—Experimental laboratory work is carried on and the literature and results obtained by coworkers in the same field studied.

Cooperation.—Association of Official Agricultural Chemists, American Public Health Association, American Chemical Society, and others.

Location.—Washington, D. C.

Date begun.—1902.

Results.—Progress has been made in perfecting apparatus and methods for detecting and measuring the radioactivity of waters, a report on the matter having been submitted. Special studies have been made of the iodin and bromin content of waters. Methods for the separating of barium and strontium have been studied.

Assignment.—W. W. Skinner, J. W. Sale, W. F. Baughman.

Proposed expenditures, 1915–16.—$1,400.

Sanitary Bottling of Waters:

Object.—To determine the best and most cleanly methods possible in the handling and bottling of waters.

Procedure.—The efficiency of bottle-washing machinery, the sterilizing and bactericidal efficiency of washing powders and compounds, and the efficiency of various types of sterilizing machinery are studied.

Location.—Washington, D. C.

Date begun.—1913.

Results.—The efficiency of certain methods of cleaning bottles has been determined by both chemical and bacteriological studies; the detergent and bactericidal efficiency of certain proprietary and ordinary washing compounds studied; the efficiency of some new solutions tested.

Probable date of completion.—1917.

Assignment.—W. W. Skinner, J. W. Sale.

Proposed expenditures, 1915–16.—$600.

Impurities in Brines and Food Salt:

Object.—To determine the impurities in food salt and their relation to health, to determine the barium chlorid and other impurities in the brines from which food salt is produced, and to determine practicable methods for the removal of such impurities in the manufacture of salt.

Procedure.—Brine and salt are analyzed and, by experiments in the laboratory and in the salt works, the best methods for removing the impurities determined.

Cooperation.—Pomeroy Salt Works, Pomeroy, Ohio, and others.

Location.—Washington, D. C., Pomeroy, Ohio, and other places.

Date begun.—1913.

Results.—As a result of laboratory experiments it was shown that the barium in the Ohio Valley brines could be economically removed in the production of salt. The laboratory experiments were confirmed by operating salt works at Pomeroy, Ohio, for seven days by the method outlined, with satisfactory results. Two reports have been prepared and submitted. Installation of permanent apparatus for treating all the brine at the Pomeroy works has been determined upon by the company.

Probable date of completion.—1917.

Assignment.—W. W. Skinner, W. F. Baughman.

Proposed expenditures, 1915–16.—$750.

Examination of Miscellaneous Waters and Related Products:

Object.—To determine the chemical composition and sanitary condition of various samples of water.

Procedure.—General analytical and research work is conducted to accomplish the above object.

Cooperation.—Forest Service, Office of Public Roads and Rural Engineering, Bureau of Biological Survey, Bureau of Fisheries, and other bureaus and offices.

Location.—Washington, D. C.

Date begun.—1902.

Results.—During the past year studies were prosecuted as follows: In cooperation with the Biological Survey, on the composition of the waters of Bear River, Utah, as a possible cause of wild duck disease; with the Forest Service, to determine the injurious effect upon cattle of certain waters; with the Office of Experiment Stations (States Relations Service), on the composition of certain samples of drainage waters. Studies were also made of the composition of water as affecting the quality of rosin and of the checking character of the distilled-water supply of the bureau.

Assignment.—W. W. Skinner, C. Huckle.

Proposed expenditures, 1915–16.—$1,500.

Total, Water Investigations, $4,250.

PHARMACOGNOSY INVESTIGATIONS.

Pharmacognosy Investigations:

Object.—To determine the chemical, physiological, and morphological characteristics of plants and drugs, and to devise new and improved methods of anaysis.

Procedure.—The usual methods applied in pharmacognostic investigations are followed.

Cooperation.—Bureaus of Plant Industry and Entomology.

Location.—Washington, D. C.

Date begun.—1914.

Results.—During the past year investigations have been conducted on the following subjects:

(1) An investigation of Lima, common, and Spanish beans has been undertaken to facilitate their differentiation. Some results of the work, which is nearly completed, were reported and demonstrated at the Association of Official Agricultural Chemists meeting last year. A study of the relation of calcium-oxalate formation to the metabolism of beans has been taken up, since the presence or absence of calcium oxalate in the seed coat is important in the differentiation of the different beans.

(2) The seed of Simaba cedron, used in Central and South America against yellow fever, snake bites, etc., has been investigated. About

Pharmacognosy Investigations—Continued.

0.14 per cent of an extremely bitter, crystalline, nitrogen-free substance (M. P. 245°) has been isolated. The solubility in different solvents has been determined quantitatively, and its chemical analysis is being undertaken.

(3) Different samples of imported mustard seeds have been examined to determine their identity. Chinese mustard seed has been found to be *Brassica cernua*. The amount and character of its ethereal oil has been studied and permission for its entrance as a substitute for other mustard seeds recommended.

(4) Some work has been done in connection with the revision of the present Pharmacopœia. Ash figures and other data of value in determining the quality of various drugs have been determined and collected.

(5) Analytical methods for the quantitative determination of ethereal oils in crude drugs, caffeine in tea, etc., are being perfected. In this connection some study has been made of the applicability of the fluorescence microscope and microsublimation to drug analysis. Micropolarization and other methods of microanalysis will be taken up.

(6) During the year 1914–15 several plants were analyzed for the presence of hydrocyanic acid. *Linum neomexicanum* had been reported poisonous to cattle and was received in an almost mature condition. This sample did not contain hydrocyanic acid or alkaloids. Hydrocyanic acid may be present in younger plants of *Linum neomexicanum*, which will be examined this season. *Tridens flavus*, which had been found to yield hydrocyanic acid, was studied further. A paper entitled "Studies on Tridens Flavus" is ready for publication. This deals with the quantity and distribution of the hydrocyanic acid and its loss under different experimental conditions. This paper was read at the meeting of biological chemists at St. Louis in December, 1914. No reliable method for the determination of hydrocyanic acid in plants was available when the bureau's work was begun. Therefore, a method was worked out and was published under the title "On the Determination of Small Quantities of Hydrocyanic Acid." This appeared in the Journal of the American Chemical Society, vol. 37. A number of plants have been examined for their saponin content. The root of *Chlorogalum pomeridianum* (California soap root) contained about 3 per cent of a saponin. This analyzed for $C_{51}H_{80}O_{23}$ and molecular weight determinations agreed with this formula. Six per cent of another saponin was found in *Agave lecheguilla*. This analyzed for $C_{25}H_{42}O_{14}$, which agreed with molecular weight determinations. These saponins were colorless and free from ash. They were poisonous to minnows. Reports on these saponins were presented to the American Chemical Society at its New Orleans meeting in April, 1914. Work was continued on the alkaloids of *Amianthium muscactoxicum*, known as crow poison. Two crystalline alkaloids were obtained but lack of material prevented further work. Report of the work in this plant also was given at the New Orleans meeting of the Chemical Society.

(7) In addition to the continuation of the investigations already under way, the work for the next fiscal year will include the following: (*a*) Comparative structures of *Viburnum opulus* and *Acer spicata*, (*b*) study of any active substance in *Strophantus courmantii kirkii*, and (*c*) detection of active substances in *Jacaranda caroba*.

Assignment.—A. Viehoever, C. O. Johns.

Proposed expenditure, 1915–16.—$10,000.

CATTLE-FOOD AND GRAIN INVESTIGATIONS.

Rice and Rice Products:

Object.—To obtain knowledge regarding the composition of paddy, hulled, and polished rice and various mill products and by-products of the same.

Procedure.—Samples of rice and rice products are obtained from the mill and these are analyzed, in order to get full knowledge regarding the characteristic of each mill product. Likewise, samples of rice are grown in the field under varying conditions and the resultant crop of rice analyzed. Attempts will be made to obtain samples of rice by-products prepared under normal factory conditions and under ideal conditions.

Rice and Rice Products—Continued.

Cooperation.—Offices of Cereal Investigations and Grain Standardization, Bureau of Plant Industry.

Location.—Headquarters, Washington, D. C.

Date begun.—1912.

Results.—Last year two complete sets of rice and rice mill products were studied. The results show the difference in composition between paddy, natural brown, and polished rice, and also give information regarding the composition of various mill products.

Probable date of completion.—1920.

Assignment.—G. L. Bidwell, W. O. Gordon, J. B. Reed, L. H. Bailey.

Proposed expenditures, 1915–16.—$1,200.

Standards for Cattle Foods:

Object.—To determine standards for malt sprouts, feed barley, mill oats, cottonseed meal, and other cattle foods.

Procedure.—Authentic samples of cattle foods are collected at source and examined and methods of manufacturing same are studied. On the basis of results obtained, standards are promulgated from time to time.

Location.—Washington, D. C.

Date begun.—1906.

Results.—A large amount of work has been performed on establishing standards; mills visited and samples examined; manufacturers shown so clearly that added screenings have no place in bran and other flour-mill by-product feeds that they have entirely changed their manufacture; method developed by which added screenings can be detected; tentative standard for malt sprouts promulgated; standard promulgated for poultry foods containing siliceous grit; a large amount of work performed and being performed on establishing standards for cottonseed products.

Assignment.—G. L. Bidwell, J. K. Haywood.

Proposed expenditures, 1915–16.—$1,000.

Effects of Storage and Transportation on Composition of Corn:

Object.—To determine the effects of storage and transportation on the chemical composition and value of corn.

Procedure.—The problem is being worked out by the Bureau of Plant Industry, samples of corn being sent to the Bureau of Chemistry for analysis.

Cooperation.—Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1910.

Results.—Analyses of 200 to 300 samples have been made in the past year.

Assignment.—J. K. Haywood, C. L. Bidwell.

Proposed expenditures, 1915–16.—$1,000.

Total, Cattle-Food and Grain Investigations, $3,200.

ORGANIC CHEMICAL INVESTIGATIONS.

Properties of Amino Acids:

Object.—To isolate, identify, and determine amino acids, as a basis for the study of the chemical aspects of foods in general and spoilage in particular.

Location.—Washington, D. C.

Date begun.—1914.

Results.—A preliminary study occupying six months' time has been made.

Assignment.—I. K. Phelps.

Proposed expenditures, 1915–16.—$3,500.

Nonsugars in Natural Sirups and Crude Sugars:

Object.—To isolate and identify nonsugars.

Procedure.—The constituents of invert sugar will be separated and identified, and after this has been accomplished the method developed will be applied to natural products.

Location.—Washington, D. C.

Date begun.—1914.

Results.—The method for invert sugar has been partially completed.

Assignment.—I. K. Phelps.

Proposed expenditures, 1915–16.—$2,500.

Organic Acids of Nature:

Object.—To isolate, identify, and determine quantitatively the organic acids of nature.

Procedure.—Usual analytical methods are employed to determine the acids in fruits, fruit products, etc.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Study of a method for estimating lactic acid is in progress.

Assignment.—I. K. Phelps, H. E. Palmer.

Proposed expenditures, 1915–16.—$3,000.

Separation and Identification of Alcohols in Food Products:

Object.—To isolate and identify alcohols found in food products.

Procedure.—Fermented products are used, with a view to the determination of the kind of food which has undergone fermentation.

Location.—Washington, D. C.

Date begun.—1915.

Assignment.—I. K. Phelps.

Proposed expenditures, 1915–16.—$2,500.

Study of the Determination of Nitrogen by the Kjeldahl Method:

Object.—To modify the Kjeldahl method for the determination of nitrogen, making it applicable to all substances containing nitrogen, including those on which the present methods will not give accurate results.

Procedure.—Experiments with different classes of organic compounds will be conducted until modifications of the Kjeldahl method are found which will be applicable to them.

Location.—Washington, D. C.

Date begun.—1914.

Results.—A preliminary paper is in course of preparation for publication.

Probable date of completion.—July, 1916.

Assignment.—I. K. Phelps, H. W. Daudt.

Proposed expenditures, 1915–16.—$2,500.

Total, Organic Chemical Investigations, $14,000.

PHARMACOLOGICAL INVESTIGATIONS.

Caffein Investigations:

Object.—To study the physiological action of caffein under various conditions and to determine the effect of this substance on health when contained in beverages or when used in medicines.

Location.—Washington, D. C.

Date begun.—1909.

Results.—Blood sugar has been shown to be increased under the influence of caffein.

Probable date of completion.—1916.

Assignment.—William Salant.

Proposed expenditures, 1915–16.—$1,000.

Toxicity and Pharmacology of Oil of Chenopodium:

Object.—Standardization of the drug.

Procedure.—Determination of the physiological action.

Location.—Washington, D. C.

Date begun.—1911.

Results.—It has been shown that the substance is toxic and cumulative; poisonous effect increased in starvation; depresses circulation and respiration; decreases irritability of smooth muscle of intestines; may produce renal irritation; toxicity may be decreased by feeding vegetable oils; examination of several samples showed variation in activity.

Probable date of completion.—1916.

Assignment.—William Salant, A. E. Livingston.

Proposed expenditures, 1915–16.—$1,000.

Pharmacology of Zinc and Tin:

Object.—To secure data on the pharmacology of zinc and tin, in order to determine the effect upon health when contained in food products.

Procedure.—The physiological action on animals is determined and compared with the effects of other heavy metals.

Pharmacology of Zinc and Tin—Continued.

Location.—Washington, D. C.

Date begun.—1912.

Results.—Diabetes and nephritis have been shown to be produced by zinc salts. The elimination of zinc takes place chiefly in the intestines and only slightly in the urine and bile; it is also stored in bones, muscle, skin, and liver. Diet is an important factor in determining the action of zinc. Tin, like zinc, decreases irritability of the smooth muscle, but is much weaker. Under certain conditions it may produce nephritis. The metal is stored in the liver, skin, bones, and muscle.

Probable date of completion.—1917.

Assignment.—William Salant.

Proposed expenditures, 1915–16.—$3,000.

Pharmacological Action of Tartrates and Citrates:

Object.—To obtain information as to the effect of tartrates and citrates on health.

Procedure.—The behavior of these substances in the body is determined by physiological and chemical methods.

Location.—Washington, D. C.

Date begun.—1912.

Results.—It has been determined that nephritis and acute and subacute intoxication in different animals is produced by tartrates; that diet is an important factor in determining toxicity; that tartrate is a heart depressant; that the depressing effect of citrate on the heart is greater than that of tartrate; and that citrate disappears rapidly from the circulation.

Probable date of completion.—1917.

Assignment.—William Salant, L. E. Wise, A. E. Livingston.

Proposed expenditures, 1915–16.—$3,000.

Pharmacological Action of Turpentine:

Object.—To determine the effect of turpentine on health when used in painting and in medicines.

Procedure.—The pharmacological action of turpentine will be studied by experimenting on animals.

Location.—Washington, D. C.

Date begun.—1914.

Probable date of completion.—1917.

Assignment.—William Salant.

Proposed expenditures, 1915–16.—$1,500.

Physiological Tests of Ergot, Cannabis Indica, and Digitalis:

Object.—To conduct physiological tests of ergot, *Cannabis indica*, and digitalis, to ascertain the quality of the drugs.

Procedure.—The physiological effect will be determined by experimenting on animals.

Cooperation.—Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1913.

Results.—Physiological studies were made on ergot obtained from various sources.

Probable date of completion.—1916.

Assignment.—William Salant.

Proposed expenditures, 1915–16.—$1,000.

Pharmacology and Toxicology of Lac Dyes:

Object.—To study the pharmacology and toxicology of lac dyes, to determine their effect on health when contained in food products.

Location.—Washington, D. C.

Date begun.—1912.

Results.—Lac dye has been found to be toxic for different animals.

Probable date of completion.—1916.

Assignment.—William Salant.

Proposed expenditures, 1915–16.—$1,500.

Pharmacology and Toxicology of Food Colors:

Object.—To study the pharmacology and toxicity of dyes, to determine their effect on health when used to color foods.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Fat-soluble dyes are transformed into water-soluble dyes and are eliminated slowly from the body.

Probable date of completion.—1918.

Assignment.—William Salant, Robert Bengis.

Proposed expenditures, 1915–16.—$3,000.

Total, Pharmacological Investigations, $15,000.

CARBOHYDRATE INVESTIGATIONS.

Investigations of Maple Products:

Object.—To compile a general index of the trade, including the securing of labels used; to investigate trade and factory methods of mixing, refining, and packing maple products; to make analyses of pure and mixed maple products; to make investigations of the original manufacture of pure maple products; and to study and improve methods for the detection of adulteration in maple products.

Procedure.—Part of the information is being secured by inspectors and part by the leader of the project personally while investigating trade and factory methods of mixing, refining, and packing maple products, by taking trips to refineries and to maple camps, where samples are secured and brought back to Washington for analysis. The study of methods for the detection of adulteration is carried out in the laboratory in Washington.

Cooperation.—Representative producers of pure products and packers of pure and mixed products; State authorities and associations.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Complete information in regard to trade practices and also copies of labels used have been secured from about two-thirds of the firms packing maple goods. Investigations have been carried out in two packing houses, and the effect of the methods of treating the sirups upon the analysis of same has been studied. Analyses of 20 samples of extremely light-colored sirups have been finished. Methods of production of extremely light-colored sirups have been studied. Some work has been done on methods for the detection of adulteration in maple products.

Probable date of completion.—1917.

Assignment.—S. F. Sherwood.

Proposed expenditures, 1915–16.—$2,000.

Chemical Investigations of Pure and Adulterated Honey:

Object.—To test methods of determining adulteration by the addition of cane sugar, commercial invert sugar, or glucose; and to study granulation and other changes in honey upon storage.

Procedure.—Methods are carried out in the laboratory in Washington on representative samples of honey.

Cooperation.—Office of Bee-Culture Investigations, Bureau of Entomology.

Location.—Washington, D. C.

Date begun.—1914.

Results.—It has been found that the crystallization of honey can be retarded or prevented by slight increases in the percentage of levulose in the honey.

Probable date of completion.—1918.

Assignment.—C. S. Hudson, T. S. Harding.

Proposed expenditures, 1915–16.—$700.

Candy Investigations:

Object.—To study the physical and chemical changes which occur during the manufacture and keeping of candy.

Procedure.—In order to learn the methods of making the simple and the more complex types of confectionery, visits are made to confectionery factories and experiments are conducted in the laboratory to establish the

Candy Investigations—Continued.

limits and proportions of ingredients, the temperatures of cooking, and related details.

Cooperation.—Several large candy manufacturers and members of the National Confectioners' Association.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Some data have been obtained concerning the preparation of several types of confectionery, which is to be published later when the field of work is covered.

Probable date of completion.—1920.

Assignment.—C. S. Hudson, J. Hamilton.

Proposed expenditure, 1915–16.—$2,000.

Study of Fruit Sirups, Jams, Preserves, Jellies, and Marmalades:

Object.—To obtain analyses of pure products and of mixtures of known origin.

Procedure.—Visits are made to large factories manufacturing jams, preserves, jellies, etc., where work is carried on and samples secured for analysis in the laboratory in Washington. Experimental work on the manufacture of the different products is also carried out in the laboratory.

Cooperation.—Manufacturing firms; Office of Pomological and Horticultural Investigations, Bureau of Plant Industry; States Relations Service.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Trips were made to a large number of jelly, jam, preserve, and marmalade factories, where samples of the various products were made and brought back to Washington for analysis. The processes of manufacture were also thoroughly studied. Experiments in manufacturing the various types of the above products were also carried out in the laboratory in Washington, with the result that excellent recipes have been worked out which have given much satisfaction. Much assistance has been given to the various canning clubs organized under the States Relations Service in the Southern States, by attending their annual meetings and giving lectures and demonstrations in jelly, marmalade, and preserve making.

Probable date of completion.—1920.

Assignment.—M. N. Straughn.

Proposed expenditure, 1915–16.—$2,500.

Preparation of Pure Carbohydrates:

Object.—To find the best methods for preparing the various sugars and other carbohydrates in pure condition.

Procedure.—Investigations carried out in the laboratory.

Cooperation.—Various laboratories of this department and outside bacteriologists working upon public-health investigations.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Improved methods have been devised for the preparation of the following sugars in pure condition: Raffinose, trehalose, the alpha and beta forms of glucose, mannose, melibiose, and galactose. The preparation of raffinose is described in a paper entitled "The Preparation of Raffinose," published in vol. 36, No. 10, of the Journal of the American Chemical Society.

Probable date of completion.—1920.

Assignment.—C. S. Hudson, T. S. Harding, E. H. Fenton.

Proposed expenditures, 1915–16.—$2,000.

Physical and Chemical Constants for Pure Carbohydrates:

Object.—To measure the optical rotation and other properties by which the carbohydrates are distinguished from one another.

Procedure.—The investigations are carried out in the laboratory.

Cooperation.—Various laboratories of this department and outside bacteriologists working upon public-health investigations.

Location.—Washington, D. C.

Date begun.—1914.

Physical and Chemical Constants for Pure Carbohydrates—Continued.

Results.—The rotatory powers of the alpha and beta forms of the following sugars have been measured, together with the characteristic velocities of their mutarotation: Glucose, galactose, lactose, xylose, lyxose, rhamnose, melibiose, mannose, fructose, cellose, and maltose.

Probable date of completion.—1920.

Assignment:—C. S. Hudson, E. Yanovsky.

Proposed expenditures, 1915–16.—$2,000.

Methods of Analysis for Carbohydrates:

Object.—To test and improve general methods and to utilize the selective action of enzyms in new methods of analysis.

Procedure.—Investigations are carried out in the laboratory.

Cooperation.—Various laboratories of this department and outside bacteriologists working upon public-health investigations.

Location.—Washington, D. C.

Date begun.—1914.

Results.—In conjunction with the project entitled "Physical and chemical constants for pure carbohydrates," the characteristic acetates of the following sugars have been prepared and their rotatory power measured in confirmation of the data of previous workers: Alpha and beta glucose, alpha and beta tetracetyl methyl glucoside, beta lactose octacetate, beta maltose octacetate, beta xylose tetracetate, beta melibiose octacetate, trehalose octacetate, sucrose octacetate, the first pentacetate of galactose, the alpha and beta octacetates of cellose, and mannose beta pentacetate. From these substances there have been prepared as new compounds the following isomeric forms, and their characteristic rotatory powers have been measured: The second, third, and fourth pentacetates of galactose, the alpha octacetates of lactose and maltose, the alpha tetracetate of xylose, the alpha pentacetate of mannose, and the alpha and beta pentacetates of fructose. This work has been described in the following publications: "A Comparison of the Optical Rotatory Powers of the Alpha and Beta Forms of Certain Acetylated Derivatives of Glucose," "The Isomeric Octacetates of Lactose," "The Isomeric Alpha and Beta Octacetates of Maltose and of Cellose," "The Isomeric Pentacetates of Mannose," "Crystalline d-Fructose Pentacetate," all of which were published in the Journal of the American Chemical Society for May, 1915; and the two following papers appeared in the June number of the same journal: "Conversion of Galactose Pentacetate to an Isomeric Form" and "The Existence of a Third Crystalline Pentacetate of Galactose."

Probable date of completion.—1920.

Assignment.—C. S. Hudson, D. H. Brauns, T. S. Harding, J. M. Johnson, A. S. Eastman.

Proposed expenditures, 1915–16.—$4,000.

Investigation of the Use of Barium and Strontium in the Manufacture of Sugar:

Object.—To investigate the barium and strontium methods as used in the manufacture of sugar, with a view to determining what amounts, if any, of the barium and strontium remain in the raw and refined sugar; also, provided barium and strontium are present, to determine in what form they occur.

Procedure.—Visits will be made to sugar factories, the above processes investigated, and samples of the finished products obtained and the necessary analyses made in the carbohydrate laboratory in Washington.

Cooperation.—Sugar factories.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1918.

Assignment.—C. S. Hudson, S. F. Sherwood.

Proposed expenditures, 1915–16.—$500.

Detection of the Characteristic Carbohydrates in Drug Plants and Foodstuffs:

Object.—To isolate and determine the characteristic sugars in drug plants and foodstuffs, in order that these substances may be used as characteristic tests for the presence or absence of the respective plant material in drugs and foods which come under examination.

Detection of the Characteristic Carbohydrates in Drug Plants and Foodstuffs—Continued.

Procedure.—Laboratory investigations in organic chemistry will be conducted.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1920.

Assignment.—C. S. Hudson, F. B. La Forge.

Proposed expenditures, 1915–16.—$1,500.

Method of Manufacture and Composition of Commercial Invert Sugar:

Object.—To investigate the method of manufacture and composition of commercial invert sugar; the information thus obtained to be used for the detection of invert sugar in adulterated honey.

Procedure.—Samples will be obtained from factories of various manufacturers and examined. Samples will also probably be obtained in the open market. Very complete chemical analyses will be made.

Location.—Philadelphia.

Date begun.—1915.

Probable date of completion.—1916.

Assignment.—Clement C. Brinton.

Proposed expenditures, 1915–16.—$500.

Total, Carbohydrates Investigations, $17,700.

DAIRY INVESTIGATIONS.

Estimation of the Total Solids of Evaporated Milk by Calculation from Its Specific Gravity and Fat Content:

Object.—To determine the best method for estimating the total solids of evaporated milk in the milk-condensing factory under factory conditions. Ordinarily there is not sufficient time to use the official method.

Procedure.—The methods for estimating the total solids now followed in factories will be tested and their accuracy determined.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1916.

Assignment.—G. E. Patrick, O. L. Evenson.

Proposed expenditures, 1915–16.—$1,000.

Determination of Alkali in Butter:

Object.—To devise methods for the detection of alkali used in the manufacture of butter.

Procedure.—Various methods for the detection of alkali will be tested by the usual laboratory methods.

Location.—Washington, D. C.

Date begun.—1913.

Results.—A method has been worked out, but more experience in using it will be necessary before any definite results can be obtained.

Probable date of completion.—1915.

Assignment.—G. E. Patrick.

Proposed expenditures, 1915–16.—$1,000.

Study of Methods for Detecting the Watering of Milk:

Object.—To ascertain if it is possible to distinguish between watered milk and genuine milk of abnormally low solids-not-fat content. The claim is made by some investigators that this distinction can be made by determining the freezing point of the milk.

Procedure.—The freezing point of milk, both genuine and watered, of low as well as of medium content of solids not fat will be determined, all samples being analyzed by the usual method and also by the method of Cornalba.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1916.

Assignment.—J. T. Keister.

Proposed expenditures, 1915–16.—$1,000

Total, Dairy Investigations, $3,000.

BEVERAGE INVESTIGATIONS.

Investigation of the Composition of Foreign Ports and Sherries and Other Wines:

Object.—To determine the composition of samples of wine of known origin and produced under known conditions.

Procedure.—In case of foreign wines, samples are procured either through the State Department or through the customs officials at the ports of entry. In case of domestic wines, these will be prepared by or under the supervision of Bureau of Chemistry representatives and analyzed.

Cooperation.—Viticulturists of the Bureau of Plant Industry.

Location.—Washington, D. C., Charlottesville, Va., and bureau branch laboratories.

Date begun.—1913.

Results.—Twenty-one samples of port wine, collected through the State Department and through the New York laboratory of the bureau, were completely analyzed. These 21 samples form the basis for an understanding of the average composition of Oporto port wine. Four samples of sherry, secured through a New York importer, were also completely analyzed. A study of the composition of wines from Rotundifolia grapes has also been begun. Three varieties of such grapes, purchased in North Carolina, were made into wine at Charlottesville, Va., the wines being analyzed before fermentation was completed. After proper aging and bottling, the wines will then be completely analyzed.

Probable date of completion.—1917.

Assignment.—M. J. Ingle.

Proposed expenditures, 1915–16.—$1,200.

Study of the Composition of Nonalcoholic Beverages:

Object.—To determine the composition of samples of known history and origin.

Procedure.—Processes of manufacture in commercial factories will be studied and the composition of nonalcoholic beverages in the laboratory determined. New methods for the analysis of such products will be devised, if necessary. The manufacture of such beverages will be witnessed and the raw material and finished beverages analyzed for comparison with samples taken in connection with the enforcement of the food and drugs act.

Cooperation.—Field work will be done in cooperation with manufacturers of nonalcoholic beverages.

Location.—Washington, D. C.

Date begun.—1915.

Results.—Owing to the large amount of regulatory work which has devolved upon the food-control laboratory, it has been impossible up to the present time to do any work on this project.

Probable date of completion.—1918.

Assignment.—H. M. Loomis, M. J. Ingle.

Proposed expenditures, 1915–16.—$700.

Investigation of the Composition of Brandies:

Object.—To determine the composition of brandy made in different ways and from various kinds of fruit.

Procedure.—Investigation of the commercial methods of the manufacture of brandy will first be made, and samples collected under known conditions will be analyzed. A study of the factors which contribute to the variation in the composition of brandy will be made.

Cooperation.—Various brandy distilleries.

Location.—Washington, D. C., and the field.

Date begun.—1915.

Results.—A preliminary survey of the commercial methods of manufacturing brandies has been made.

Probable date of completion.—1917.

Assignment.—H. S. Paine, J. I. Palmore, E. L. Wilcox.

Proposed expenditures, 1915–16.—$500.

Investigation of the Composition of Cordials:

Object.—To determine the composition of representative types of commercial cordials made from fruit and fruit products.

Procedure.—A study of commercial methods for the manufacture of these products will first be undertaken and samples of cordials prepared from known materials in accordance with commercial procedure analyzed.

Cooperation.—Various cordial manufacturers.

Location.—Washington, D. C., and the field.

Date begun.—1915.

Results.—Information regarding the commercial methods and practices employed in the manufacture of cordials has been obtained, samples of known composition collected, the literature pertaining to the project reviewed, and the examination of the samples collected is now under way.

Probable date of completion.—1916.

Assignment.—H. S. Paine, J. I. Palmore.

Proposed expenditure, 1915–16.—$1,970.

Investigation of the Composition of Malt Beverages:

Object.—To determine the composition of malt beverages made from different materials.

Procedure.—This project will involve a study of the composition of malt liquors made from material including 6-row Pacific-coast barley malt.

Cooperation.—Various breweries; as associate referee on beer, the Association of Official Agricultural Chemists.

Location.—Washington, D. C., and cities in which breweries are located.

Date begun.—1911.

Results.—The examination of malt liquors made from materials including 6-row barley malt (except Pacific-coast 6-row barley malt) has been completed, and investigation has shown that the amount of 2-row barley malt used in brewing in this country is practically negligible. The results which have been obtained have been compiled and submitted for publication.

Probable date of completion.—1916.

Assignment.—H. S. Paine, E. L. Wilcox.

Proposed expenditures, 1915–16.—$730.

Study of Methods of Analysis of Distilled Liquors:

Object.—To improve these methods, especially the methods employed for the determination of fusel oil; and to study the effect of essential oils on the latter determination.

Procedure.—Experimental work will be carried out with the idea of determining the necessary limits of error in existing methods and of improving these methods or of devising new ones.

Location.—Washington, D. C.

Date begun.—1914.

Results.—A review of the literature has been completed and experimental work is under way.

Probable date of completion.—1916.

Assignment.—H. S. Paine.

Proposed expenditures, 1915–16.—$1,380.

Study of So-Called Wines Prepared from Fruit or Vegetables Other than the Grape:

Object.—To determine the composition and methods of manufacture of such products.

Procedure.—It is planned to visit factories where such wines are made and study commercial methods; to prepare wines of known purity on a commercial scale; and to analyze the raw material, if necessary, as well as the resulting wine, in order to secure data for judging such products.

Cooperation.—Manufacturers.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—1917.

Assignment.—M. J. Ingle, S. Coopersmith.

Proposed expenditures, 1915–16.—$1,000.

Total, Beverage Investigations, $7,480.

DRUG INVESTIGATIONS.

Study of Methods of Drug Analysis:

Object.—To study methods of analysis of drug products and to develop new procedures for the detention, separation, and estimation of synthetic drugs in medicinal and other preparations.

Procedure.—Established methods will be investigated and, if found adequate, will be used; otherwise new methods will be developed.

Cooperation.—Bureau of Plant Industry, State and municipal officials, and Association of Official Agricultural Chemists.

Location.—Washington, D. C.

Date begun.—1907.

Results.—A number of methods of analysis have been developed and published for the estimation of acetanilid and phenacetin in admixture, for the estimation of antipyrin, the estimation of caffein and antipyrin in admixture, estimation of phenacetin and salol in admixture, and the determination of santonin.

Assignment.—L. F. Kebler, W. O. Emery, E. K. Nelson.

Proposed expenditures, 1915–16.—$7,500.

Permissible Variations in Drug Products:

Object.—To determine what should constitute permissible variations in the composition of drug products under different conditions.

Procedure.—The products are first subjected to a physical and chemical examination. The data resulting therefrom are then considered in connection with possible seasonal influences, in order to establish a reasonable basis for proposed limits of variation.

Cooperation.—Bureau of Plant Industry, and State and municipal officials.

Location.—Washington, D. C.

Date begun.—1907.

Results.—Permissible variations in a number of drug products have already been determined, notably in the case of fennel, coriander, cardamom, anise, and celery seeds.

Assignment.—L. F. Kebler.

Proposed expenditures, 1915–16.—$4,000.

Elimination of Inert and Objectionable Material in Crude Drugs:

Object.—To study methods of elimination of inert and objectionable material during the process of gathering crude drugs.

Procedure.—The nature and extent of contamination are first ascertained by the aid of physical methods and appropriate means of rectification thereupon suggested or applied.

Cooperation.—Bureau of Plant Industry and State and municipal officials.

Location.—Washington, D. C.

Date begun.—1907.

Results.—Owing to pressure of other duties no work was carried out on this project during the past year.

Assignment.—L. F. Kebler.

Proposed expenditures, 1915–16.—$1,500.

Total, Drug Investigation, $13,000.

Total, Enforcement of the Food and Drugs Act, $785,943 (research, $177,831; regulation, $608,112), not including $14,358 reserve fund.

[Research.]

INVESTIGATION OF NAVAL STORES.

Investigation of the Grading, Weighing, and Handling of Naval Stores:

Object.—To improve the methods of grading, weighing, and handling of naval stores; to secure the adoption of a definite and universal procedure in grading, weighing, and handling rosin and turpentine, that the producers may be paid full value for their product and that the buyer may secure delivery of the grade purchased; to serve as referee at the expense of the parties to the transaction in disputed gradings and weighings; and to secure data to serve as a basis for the authoritative adoption of standard grades of naval stores.

Investigation of the Grading, Weighing, and Handling of Naval Stores—Con.

Procedure.—The distillation, packing, grading, weighing, and handling of naval stores will be studied and observed at the stills of the producers, at the primary yards of the country, in the hands of the larger buyers, and finally in the hands of the users. Shipments will be followed from producer to user for the purpose of developing improper practices in dealings, if any, with a view to making necessary changes in methods of producing, grading, packing, weighing, and marketing.

Cooperation.—The naval-stores industry; National Oil, Paint, and Varnish Association; Savannah Board of Trade; naval-stores inspectors of Georgia and Florida and of the New York Produce Exchange.

Location.—Headquarters, Washington, D. C., and Savannah, Ga. Experiments will be made at 15 or 20 stills in North Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. Experimental gradings and weighings will be made in New York City, Cincinnati, Ohio, Savannah, Ga., Jacksonville, Fla., and at other large cities and in the hands of users.

Date begun.—1910.

Results.—A simple and accurate method for grading at the still has been devised. Two publications dealing with the adulteration, misgrading, methods of examination, standards, and grading at the still have been published. The losses borne either by the producers or users which arise from misgrading and adulteration have been indicated in these publications. The people are being educated as to the extent of the frauds that have been practiced and in methods of improved grading, handling, marketing, and production.

Probable date of completion.—As to research, 1916. Extension work and refereeing in disputes will continue.

Assignment.—F. P. Veitch, C. F. Speh, V. E. Grotlisch.

Proposed expenditures, 1915-16.—$3,500.

Preparation of Definite Type Samples for Naval Stores:

Object.—To prepare definite and permanent type samples as a basis for trading and to insure fair, uniform, and simple grading of naval stores.

Procedure.—The colors and variations in color within the type of the type samples commonly employed have been measured. The average of these type colors, with certain obvious and logical exceptions, are adopted as the basis of durable and accurately matched colors of glass held in a frame of the accepted size of the grading samples. These type samples will be deposited with trade bodies having supervision over dealings in naval stores and will also be sold at cost to those who ask for them. Types will be perfected and sets prepared for public distribution.

Cooperation.—Naval-stores industry; Savannah Board of Trade; State naval-stores inspectors of Georgia and Florida and of the New York Produce Exchange.

Location.—Headquarters, Washington, D. C.

Date begun.—1911.

Results.—Durable, accurate, and practical type samples for rosin have been prepared and distributed for preliminary practical experience and observations. These types have been adopted as official by the Savannah Board of Trade.

Probable date of completion.—As to standardization of types, July, 1916. Work in the preparation and verification of types for the benefit of the industry will continue.

Assignment.—C. F. Sammet, C. F. Speh.

Proposed expenditures, 1915-16.—$1,500.

Total, Investigation of Naval Stores, $5,000.

BUREAU OF SOILS.

GENERAL ADMINISTRATION.

Office of Chief of Bureau:

Object.—General administration, supervision, and direction of the activities and operations of the bureau.

Cooperation.—Other bureaus of the department, other departments, and State institutions.

Location.—Washington, D. C.

Date begun.—1894.

Assignment.—Milton Whitney.

Proposed expenditures, 1915–16.—$5,400.

Office of Chief Clerk:

Object.—The chief clerk is charged with carrying out the directions and policies of the chief of bureau, as these relate to supervision and control of the clerical work, including the handling of correspondence and mail, stenographic and messenger service, and property and supplies.

Location.—Washington, D. C.

Date begun.—1901.

Assignment.—A. G. Rice.

Proposed expenditures, 1915–16.—$14,760.

Accounts:

Object.—To keep proper records of all financial operations of the bureau, prepare travel authorizations, issue purchase requisitions, make administrative examinations of all accounts, prepare pay rolls, keep liability records and prepare monthly statements of the same, and prepare such other financial reports as may be required from time to time.

Location.—Washington, D. C.

Date begun.—1901.

Assignment.—C. A. Wolfe.

Proposed expenditures, 1915–16.—$4,400.

Editorial Work:

Object.—To read for the chief of bureau all manuscripts submitted for publication, edit or rewrite such manuscripts as may be necessary to bring them into harmony with the bureau's policy, compile data for use of the soil survey field men, rewrite or rearrange reports not submitted in proper form, read and correct proof, and assist in the preparation of specifications for the lithographic reproduction of maps and in the proofreading of the same.

Location.—Washington, D. C.

Date begun.—1901.

Assignment.—Chas. H. Seaton.

Proposed expenditures, 1915–16.—$7,400.

Supplies:

Object.—To supervise and distribute all supplies and equipment purchased for field, laboratory, and office use and record the same.

Location.—Washington, D. C.

Date begun.—1901.

Assignment.—J. F. Pevare.

Proposed expenditures, 1915–16.—$4,700.

Files and Records:

Object.—To index and file all correspondence pertaining to the operations of the bureau.

Location.—Washington, D. C.

Date begun.—1901.

Assignment.—H. A. Donovan.

Proposed expenditures, 1915–16.—$2,400.

Total, General Administration, $39,060.

[Research.]

SOIL CHEMICAL INVESTIGATIONS.

Supervision:

Object.—To direct the soil chemical investigations and to supervise the routine laboratory and clerical work necessary for the proper conduct of these activities.

Location.—Washington, D. C.

Date begun.—1901.

Assignment.—F. K. Cameron.

Proposed expenditures, 1915–16.—$3,250.

Mineral Nature of Agriculturally Important American Soils:

Object.—To determine predominating minerals or those which characterize the soil, with a view to determining the origin, processes of formation, and relations of the various soil types.

Procedure.—A special adaptation of petrographic methods is used, as outlined in Bureau of Soils Bulletin 91.

Location.—Washington, D. C.

Date begun.—1908.

Results.—Methods have been perfected. Minerals from a great number of soils have been determined and the data made available for this bureau and outside institutions. Results have thrown light on the chemistry of soils and in some cases have eliminated a large number of chemical analyses. The precise nature of certain soils has been shown to be determinable (Journal of the American Society of Agronomy, vol. 6, 1914).

Assignment.—W. H. Fry.

Proposed expenditures, 1915–16.—$600.

Routine Microscopic Work:

Object.—Routine examination of soils and other materials submitted by this bureau and other institutions.

Location.—Washington, D. C.

Date begun.—1915.

Results.—During the present year a large number of samples have been examined.

Assignment.—W. H. Fry.

Proposed expenditures, 1915–16.—$900.

Absorption by Soils:

Object.—To determine the effect on soils of the addition of soluble substances and the mutual effects of one soluble substance in the presence of another; and to determine the fixation of fertilizer salts by soils, the physicochemical effects on the soil, an dthe relation of soluble salts to changes in tilth.

Procedure.—Percolation and adsorption studies with fertilizer salts, lime, etc., and soils of different textures are made. It is planned to study specially during the present year the effect of lime on crumbling of soils and modifications induced by added third substances; also selective absorptions in soil suspensions.

Location.—Washington, D. C.

Date begun.—1905.

Results.—It has been shown that the presence of a second solute does affect the absorption of a first solute by a soil and that the effects are specific and characteristic and not due to a general property or properties of the class of solutes.

Assignment.—E. G. Parker.

Proposed expenditures, 1915–16.—$1,600.

Lime Phosphate Investigations:

Object.—To investigate the nature of the lime phosphates occurring naturally in soils and produced by the application of phosphatic fertilizers.

Procedure.—The phase-rule methods are applied to the investigation of the solutions and the solid lime and iron phosphates formed in soil. Specially refined analytical methods must be developed for this case. The solid lime-iron phosphates will be studied. The nature of the liquid phase and the solid phases in the systems and the lime-iron water are

Lime Phosphate Investigations—Continued.

determined under conditions paralleling those obtaining in the soil. Efforts are being made to develop laboratory procedures not yet known for carrying out this investigation.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Nature of solid phosphates of lime, magnesia, and iron in contact with free solutions have been determined. Similar problems in connection with very dilute solutions and for soil water have been investigated. Various basic lime phosphates have been prepared for a continuation of the investigation by fusion methods, and improved analytical methods, necessary to the investigations, have been worked out. Appropriate analytical methods have been found in part.

Probable date of completion.—1916.

Assignment.—P. J. Fox.

Proposed expenditures, 1915–16.—$1,250.

Inorganic Composition of Soils:

Object.—To determine in soils and subsoils of important agricultural soils of the United States all inorganic constituents for which reliable analytical methods are available.

Procedure.—The collection of large samples from surveyed areas by field men familiar with the type, with careful handling to prevent contamination, followed by careful laboratory analyses of the samples.

Location.—Washington, D. C.

Date begun.—1911.

Results.—Twenty-six soils have been analyzed for all constituents for which there are reliable methods, and 45 samples have been analyzed for the commoner elements. The rarer elements—chromium, vanadium, rare earths, zirconium, barium, strontium, lithium, and rubidium—were present in all soils examined. It was found that manganese and phosphorus concentrated in the surface soil and that all soils examined contain an abundance of potash minerals. Further points are brought out in Department Bulletin 122 (professional paper).

Probable date of completion.—The work on this project as originally outlined is practically completed, but it is considered desirable to perfect new methods of analysis for some of the rarer constituents not already determined.

Assignment.—W. O. Robinson.

Proposed expenditures, 1915–16.—$1,500.

Ash Composition of Important Crop Plants:

Object.—To determine what elements that have been found in soils are present in plant ash, especially the rarer elements, and the relative amounts of these in the ash.

Procedure.—The analyses of plants grown on soils the composition of which is known.

Location.—Washington, D. C., and field assignments.

Date begun.—1912.

Results.—It appears that rubidium is often present in comparatively large amounts and that the number of elements which can be recognized is always large. Analytical methods are being perfected.

Probable date of completion.—1916.

Assignment.—W. O. Robinson.

Proposed expenditures, 1915–16.—$2,550.

Hydrolytic Decomposition of Soil-Forming Minerals:

Object.—To study the action of water and such substances as may exist in the soil solution upon the decomposition and degradation of soil minerals and the possible synthesis of new mineral species.

Procedure.—The work involves chemical studies of hydrolysis products when water acts on minerals, under soil conditions, and chemical and microscopic studies of residues; studies of solutions yielded by minerals important in the soils, under conditions of temperature, mechanical fineness of soil, presence of organic matter, acidity, etc.; field investigations as to changes in minerals from solid rock to soil.

Hydrolytic Decomposition of Soil-Forming Minerals—Continued.

Location.—Washington, D. C., and field assignments.

Date begun.—1901.

Results.—An exact method of subjecting minerals to electrical endosmose has been developed; data collected on soil solutions yielded by important soil minerals and on the variation of these solutions under conditions obtaining in the soil; a rational theory of the function and importance of the soil solution developed.

Assignment.—P. J. Fox.

Proposed expenditures, 1915–16.—$1,650.

Routine Chemical Laboratory:

Object.—To make chemical analyses of soils, waters, and similar materials for the bureau and other bureaus of the department and properly accredited parties.

Location.—Washington, D. C.

Date begun.—1901.

Results.—Analytical data provided for various subactivities of the bureau and outside institutions.

Assignment.—J. G. Smith.

Proposed expenditures, 1915–16.—$5,540.

Methods of Determining Nitrogen in Soils and Fertilizers:

Object.—To determine relative values of existing analytical methods or new ones to be formulated, with special reference to the valuation of city wastes.

Procedure.—New methods will be tested and compared with standard methods, using soils of known composition, fertilizers of known agricultural value, and nitrogenous waste materials. When the analytical work has been sufficiently developed it is expected to seek assistance from the Bureau of Plant Industry and experiment stations through field tests.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Work temporarily suspended during the fiscal year 1915 on account of limited personnel, but to be resumed about July 1, 1915.

Probable date of completion.—1917.

Assignment.—C. F. Miller.

Proposed expenditures, 1915–16.—$1,850.

Significance of Analytical Data for Soil Productivity:

Object.—To make a critical comparison of existing analytical data for soils of known productivity.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Merely preliminary work done.

Assignment.—P. J. Fox.

Proposed expenditures, 1915–16.—$930.

Liming of Soils:

Object.—To determine the effects of liming and a proper basis for the practice of liming soils.

Procedure.—The physicochemical changes produced in soil by liming are to be investigated by laboratory methods. Biological changes are not to be studied specifically, but it is planned, when the laboratory studies have been developed to the point where the results can be utilized in field observations, to seek the assistance of the Bureau of Plant Industry and State organizations.

Location.—Washington, D. C., and field assignments.

Date begun.—1914.

Results.—No definite results on this activity can be announced pending a thorough search of the literature and the completion of certain experiments on the absorption of lime by soils.

Assignment.—E. G. Parker.

Proposed expenditures, 1915–16.—$1,150.

Total, Soil Chemical Investigations, $22,770.

[Research.]

SOIL PHYSICAL INVESTIGATIONS.

Supervision:

Object.—To direct the soil physical investigations and to supervise the routine laboratory and clerical work necessary for their proper conduct.
Location.—Washington, D. C.
Date begun.—1901.
Assignment.—F. K. Cameron.
Proposed expenditures, 1915–16.—$3,250.

Designing, Construction, and Standardization of Instruments:

Object.—To assist the activities of the bureau by furnishing or standardizing physical instruments.
Location.—Washington, D. C.
Date begun.—1901.
Results.—Assistance rendered other activities.
Assignment.—C. J. Crawley.
Proposed expenditures, 1915–16.—$1,750.

Mechanical Analyses of Soils:

Object.—To determine quantitatively the mechanical separates for an expression of the textural characteristics of soils.
Procedure.—Soil particles are separated according to the routine method outlined in Bureau of Soils Bulletin 84.
Location.—Washington, D. C.
Date begun.—1901.
Results.—Data provided for soil surveys and other activities.
Assignment.—W. B. Page.
Proposed expenditures, 1915–16.—$2,800.

Soil Pressure:

Object.—To determine the magnitude of the soil stresses induced by changing moisture content.
Procedure.—Measurements are made in the laboratory of stresses produced by the wetting of dry soils at minimum volume. Effects in soil separates and of colloidal matter are to be investigated.
Location.—Washington, D. C.
Date begun.—1913.
Results.—Quantitative measurements of stresses in various soil types and improvements in method and technique have been made.
Probable date of completion.—1916.
Assignment.—L. B. Olmstead.
Proposed expenditures, 1915–16.—$450.

Translocation of Soil Particles:

Object.—To observe relative movements of large and small particles under alternate wetting and drying.
Procedure.—Relative rates and directions of movement of soil particles are measured.
Location.—Washington, D. C.
Date begun.—1906.
Results.—"Natural packing" explained; interchange of soil and subsoil material shown to be continuous; clodding, phenomena of soil drainage, etc., elucidated.
Probable date of completion.—1916.
Assignment.—L. B. Olmstead.
Proposed expenditures, 1915–16.—$185.

Soil Erosion:

Object.—To investigate causes for and control of erosion in soils in different types and under various climatic conditions.
Procedure.—Field examinations are to be made of existing conditions, supplemented by laboratory examinations of soils.
Location.—Washington, D. C., and field assignments.
Date begun.—1913.
Results.—The various types of erosion in Southern and Pacific Coast States have been investigated, causes determined, and preventive and remedial

Soil Erosion—Continued.
methods critically examined. Publications: "Soil Erosion in the South," Department Bulletin 180; "The Economic Waste from Soil Erosion," Department Yearbook, 1913.
Assignment.—R. O. E. Davis.
Proposed expenditures, 1915–16.—$1,000.

Movement of the Soil Solution:
Object.—To investigate the relation of surface texture to movement of the soil solution, with a view to determining the general laws of distribution of soil moisture.
Location.—Washington, D. C.
Date begun.—1906.
Results.—General law deduced and verified experimentally; distribution of rainfall deduced theoretically and confirmatory experimental data obtained. Publication: "Simple Method of Determining Critical Moisture Content of Soils," Journal of Industrial and Engineering Chemistry, vol. 6, 1914.
Assignment.—R. O. E. Davis.
Proposed expenditures, 1915–16.—$1,600.

Soil Hygrometer:
Object.—To utilize the Wheatstone bridge or other instruments in estimating the moisture content of soils.
Procedure.—Search to be made for some physical property of soils which bears a quantitatively measurable relation to the moisture content; heat conductivity relationships to be investigated.
Location.—Washington, D. C.
Date begun.—1901.
Results.—Continued efforts have been made to work out a practical instrument mainly on the basis of a slide wire bridge.
Assignment.—L. B. Olmstead.
Proposed expenditures, 1915–16.—$550.

Absorption by Soils:
Object.—To determine the effect of various substances upon salts in the fixation of fertilizer constituents by soils.
Location.—Washington, D. C.
Date begun.—1901.
Results.—General laws deduced in connection with chemical investigations. The physical work was temporarily suspended during the past year because of limited personnel, but will be resumed about July 1, 1915. Parallel work in soil chemistry is now proceeding.
Assignment.—L. H. Greathouse.
Proposed expenditures, 1915–16.—$1,350.

Soil Temperatures:
Object.—To investigate heat conductance of soils and the relation of temperature and solar radiation to soil conditions.
Procedure.—The work involves obtaining complete continuous records of temperatures at various depths of soil, together with complete records of solar and sky radiation.
Location.—Washington, D. C., and Arlington, Va.
Cooperation.—Weather Bureau, which furnishes records of solar radiation at regular intervals.
Date begun.—1901.
Results.—General laws as influenced by texture and moisture content investigated; advice based upon experimental examination given for a number of special cases met in actual practice by parties seeking assistance from the bureau.
Assignment.—R. O. E. Davis.
Proposed expenditures, 1915–16.—$1,500.

Soil Aeration:
Object.—To investigate changing conditions of soil atmosphere and their effect on productivity.
Procedure.—Study of composition of soil atmosphere and its movements as influenced by barometric pressure, temperature, texture, and tillage.

Soil Aeration—Continued.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—1901.

Results.—Observations on the absorption and retention of carbon dioxid made in connection with other subactivities. Work was temporarily suspended during the past year for lack of personnel, but will be resumed about September, 1915.

Assignment.—R. O. E. Davis.

Proposed expenditures, 1915–16.—$1,250.

Total, Soil Physical Investigations, $15,685.

[Research.]

INVESTIGATIONS OF FERTILIZER RESOURCES.

Supervision:

Object.—To direct the investigations of fertilizer resources of the United States and to supervise the routine laboratory and clerical work necessary for their proper conduct.

Location.—Washington, D. C.

Date begun.—1911.

Assignment.—F. K. Cameron.

Proposed expenditures, 1915–16.—$3,250.

Extraction of Potassium Salts from Kelp:

Object.—To investigate the practicability and economic value of various methods of extracting potassium salts from kelp.

Procedure.—Laboratory examination will be made to test the comparative merits of different methods of reducing kelp and extracting kelp ash.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—1913.

Results.—The extraction of potassium salts from kelp has been shown to be economically possible.

Assignment.—A. R. Merz.

Proposed expenditures, 1915–16.—$200.

Effect of Harvesting and Other Factors on the Growth of Kelp:

Object.—To determine the effect of different methods of harvesting on the growth of kelp.

Location.—Washington, D. C., and La Jolla, Cal.

Date begun.—1912.

Results.—It has been shown that the harvesting of kelp under certain conditions induces an increased growth, that the neighborhood of fresh-water streams has little influence, and that storms frequently destroy temporary growth. It will be desirable to continue observations for several years or until a stable kelp industry is established.

Assignment.—W. C. Crandall.

Proposed expenditures, 1915–16.—$250.

Fixation of Atmospheric Nitrogen:

Object.—To investigate new processes of fixing nitrogen by reduction methods.

Procedure.—Studies are made of the use of phosphate rock and of feldspar in the fixation of atmospheric nitrogen by means of electrical energy, with a view to obtaining in one operation two or more of the fertilizing elements in soluble form.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—1913.

Results.—Results of preliminary experiments (Journal of Industrial and Engineering Chemistry, vol. 5) have shown that the potash in feldspar can be completely volatilized when treated according to the procedure outlined and that considerable fixation of nitrogen takes place in the residue at the same time. Equipment is being installed to continue the work on a larger scale and at higher temperatures.

Assignment.—W. H. Ross, Harry Bryan.

Proposed expenditures, 1915–16.—$11,000.

Production of Potash from Feldspar:

Object.—To determine commercially possible methods for utilizing feldspar as a source of potash for fertilizer production.

Procedure.—The practicability of recovering potash from rock silicates by substituting the latter for clay in manufacture of cement or similar products and recovering the potash by volatilization is being studied.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—1912.

Results.—Preliminary experiments have shown that it is possible, when operating according to the procedure outlined, to completely volatilize the potash from feldspar at the temperature used in cement manufacture and that the residue obtained has the composition required by Portland cement. With a view to making further tests in the economic possibilities of the process, equipment is being installed to carry on the work on a larger scale, using the rotary and cupola types of furnaces. An inspection has been made of an experimental plant operated on a commercial scale in which the latter type of furnace is used.

Assignment.—W. H. Ross, Harry Bryan.

Proposed expenditures, 1915–16.—$2,000.

Extraction of Phosphoric Acid from Natural Phosphates:

Object.—To compare the sulphuric acid and electrical methods of extracting phosphoric acid from natural phosphates and to devise improvements in these methods.

Procedure.—This work involves a study of the volatilization of phosphoric acid from phosphate rock by electrical and other forms of heat energy; a comparison of the efficiency of methods devised with the sulphuric-acid method or improvements in the latter method, and an investigation of the most economical methods of separating phosphoric acid from solution.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—1913.

Results.—A possible improvement in the sulphuric-acid method for preparing phosphoric acid has been devised, and an investigation has been made of a method of separating phosphoric acid from solution, as obtained in either the sulphuric-acid or electrical methods, by precipitating it by means of ammonia in the form of ammonium phosphate. A study of the best conditions under which this can be brought about is in progress.

Assignment.—W. H. Ross, Harry Bryan.

Proposed expenditures, 1915–16.—$5,000.

Phosphate Industry of the United States:

Object.—To investigate the sources, quantity, and production of phosphate rock, its manipulation for the fertilizer industry, the relative merits of the products obtained by the several manipulations, and other factors necessary to determine the cost to the farmer and that he may keep in touch with changing conditions.

Procedure.—Consultation with manufacturers and consumers of phosphate-carrying materials by correspondence and in person; visiting and consulting officials of State colleges and experiment stations and conducting laboratory investigations in Washington with a view to ascertaining the availability and fertilizer value of finely ground raw phosphate rock and other forms of phosphate fertilizer.

Location.—Washington, D. C., and field assignments.

Date begun.—1911.

Results.—Summary of present conditions prepared, which is to be kept up to date by periodical revision. One field trip in the investigation of the fertilizer value of ground phosphate rock has been made.

Assignment.—W. H. Waggaman.

Proposed expenditures, 1915–16.—$2,750.

Phosphate Deposits in Virginia:

Object.—To investigate the commercial importance of reported deposits in Albemarle, Nelson, and Roanoke Counties, Va.

Procedure.—Field inspection will be made and laboratory samples examined.

Cooperation.—State geologist of Virginia.

Phosphate Deposits in Virginia—Continued.

Location.—Washington, D. C.; Charlottesville, Va.; and field assignments.

Date begun.—1913.

Results.—Field inspection and laboratory examination of samples show some economic possibilities. Publication: "A Possible Commercial Utilization of Nelsonite," Journal of Industrial and Engineering Chemistry, vol. 5, 1913. Complete analyses of samples of phosphate from Albemarle County, Va., now being made.

Probable date of completion.—December, 1915.

Assignment.—W. H. Waggaman.

Proposed expenditures, 1915–16.—$500.

Concentration of Low-Grade Phosphates:

Object.—To determine a method of conserving mine wastes.

Procedure.—Mechanical and chemical methods of separating phosphoric acid from impurities with which it is associated in the material at present discharged on the waste heaps are followed.

Location.—Washington, D. C., and field assignments.

Date begun.—1913.

Results.—Some preliminary results have been obtained from the treatment of hard rock-phosphate waste, which show that a partial separation of the phosphoric acid is mechanically practicable. Work is being continued with other varieties of phosphate waste.

Assignment.—W. H. Waggaman.

Proposed expenditures, 1915–16.—$3,500.

Production of Raw Materials in the United States for Fertilizer Manufacture:

Object.—To obtain accurate and authentic data, by correspondence with producers and by occasional visits to mines and factories, regarding available or partially available resources.

Cooperation.—Miners and manufacturers.

Location.—Washington, D. C., and field assignments.

Date begun.—1912.

Results.—Summaries made, which will be periodically revised.

Assignment.—C. C. Fletcher.

Proposed expenditures, 1915–16.—$620.

Fertilizer Value of City and Trade Wastes:

Object.—To determine the amount and value of city and trade wastes as sources of commercial fertilizer material.

Procedure.—Inspection of various municipal disposal plants are made, analyses of samples collected, and a study of practical methods of preparing garbage and other tankage undertaken.

Location.—Washington, D. C.; Arlington, Va.; and field assignments.

Date begun.—1913.

Cooperation.—City authorities of Washington, D. C., and municipal officers of various other cities.

Results.—The more important garbage-disposal plants in the country have been visited and data for comparing the relative value of different processes collected. An investigation of the garbage of Washington, D. C., is being made in cooperation with the municipal authorities, to determine the most economical methods of disposal and utilization. A large amount of data has been secured, but it is not yet feasible to announce what definite conclusions will ultimately be justified thereby.

Assignment.—J. W. Turrentine.

proposed expenditures, 1915–16.—$7,550.

Extraction of Potassium Salts from Natural Brines:

Object.—To determine the feasibility of utilizing large occurrences of American brines as sources of potash.

Procedure.—Crystallization and other methods will be followed to determine the feasibility of segregating the potassium content sufficiently to justify commercial exploitation of the large brine bodies in the United States.

Location.—Washington, D. C., and Arlington, Va.

Date begun.—1915.

Extraction of Potassium Salts from Natural Brines—Continued.

Results.—Preliminary results indicate the possibility that brines may be a contributory source of potassium salts.

Assignment.—A. R. Merz.

Proposed expenditures, 1915–16.—$300.

Total, Investigations of Fertilizer Resources, $36,920.

[Research.]

SOIL-SURVEY INVESTIGATIONS.

Supervision:

Object.—To plan and direct all field activities connected with soil-survey investigations. conduct correspondence and supervise general office work, study soil development, correlation, and classification in the field, and make recommendations on the final correlation of soils.

Cooperation.—Other bureaus of the department and State organizations.

Location.—Washington, D. C.

Date begun.—1898.

Assignment.—Curtis F. Marbut.

Proposed expenditures, 1915–16.—$13,550.

Soil Surveys—Detail and Reconnoissance:

Object.—This work consists of the mapping of the soils of important areas in different parts of the United States and the preparation of maps showing their distribution and of reports describing them. The purpose is to acquire a knowledge of the soils of the United States and make it available for use by other bureaus and departments, agricultural colleges, experiment stations, and others engaged in the development of agricultural interests.

Results.—The following areas were completed during the fiscal year 1915:

Alabama: Barbour, Clay, Limestone, Walker, and Washington Counties.
Arkansas: Columbia and Jefferson Counties.
California: Honey Lake, Pasadena, San Bernardino, and Ukiah detail areas; San Francisco Bay region and San Diego reconnoisance areas.
Florida: Fort Lauderdale area and Franklin County.
Georgia: Dekalb, Jackson, Laurens, Polk, Turner, and Washington Counties.
Indiana: Clinton, Elkhart, and Warren Counties.
Iowa: Lee, Muscatine, Pottawattamie, and Webster Counties.
Louisiana: Lafayette Parish.
Maryland: Montgomery County.
Minnesota: Pennington County.
Mississippi: Chickasaw, Coahoma, Grenada, and Jefferson Davis Counties.
Missouri: Dunklin, Grundy, Harrison, Johnson, and Pettis Counties.
Montana: Bitter Root Valley area.
Nebraska: Gage, Nemaha, Seward, and Thurston Counties.
New York: Clinton and Chautauqua Counties.
North Carolina: Columbus, Lincoln, Rowan, Union, Wake, and Wayne Counties.
North Dakota: Dickey and Lamoure Counties.
Ohio: Paulding, Portage, and Trumbull Counties.
Oklahoma: Roger Mills County.
Pennsylvania: Lancaster County.
South Carolina: Dorchester and Hampton Counties.
Texas: Smith and Taylor Counties.
Virginia: Frederick County.
West Virginia: Raleigh, McDowell, and Wyoming Counties.
Wisconsin: Central reconnoissance.
Washington: Franklin County.

Work planned.—The areas approved by the Secretary for survey work during the summer season of 1915 are as follows:

SOIL SURVEY—DETAIL AREAS.

Location.	Cooperation.	Probable date of completion.	Assignment.	Proposed expenditures, 1915-16.
Monroe County, Ala.	Alabama Department of Agriculture and Industries and Alabama Experiment Station.	June, 1916	H. C. Smith [1]	$3,000
Pickens County, Ala.	do	April, 1916	A. M. O'Neal, and other State representatives.	None.[2]
Wilcox County, Ala.	do	do	R. A. Winston [1]	2,750
Yell County, Ark.	Arkansas Experiment Station.	August, 1915	E. B. Deeter [1]	600
Russian River Valley area, Cal.	University of California and California Experiment Station.	October, 1915	E. B. Watson [1]	900
Newcastle County, Del.	Delaware College and Experiment Station.	do	T. M. Morrison [1]	880
Wilkes County, Ga.	Georgia State College.	September, 1915	D. D. Long, State representative.	None.[2]
Latah County, Idaho.	Idaho Experiment Station.	November, 1915	J. H. Agee [1]	1,300
Grant County, Ind.	Indiana Geological Survey.	do	L. A. Hurst [1]	1,470
Wells County, Ind.	do	October, 1915	W. E. Tharp [1]	900
White County, Ind.	do	do	T. M. Bushnell [1]	720
Clinton County, Iowa.	Iowa State College of Agriculture and Experiment Station.	November, 1915	H. W. Walker [1]	1,000
Scott County, Iowa.	do	do	E. H. Stevens [1]	1,000
Sioux County, Iowa.	do	December, 1915	E. H. Smies [1]	1,300
Van Buren County, Iowa.	do	November, 1915	C. Lounsbury [1]	1,100
Cowley County, Kans.	Kansas Agricultural College and Experiment Station.	December, 1915	E. C. Hall	1,400
Jessamine County, Ky.		September, 1915	R. T. Allen	550
Cumberland County, Me.		June, 1916	C. Van Duyne, M. W. Beck	3,500
Calhoun County, Mich.		December, 1915	W. G. Smith, R. F. Rogers	2,350
Buchanan County, Mo.	University of Missouri and Missouri Experiment Station.	October, 1915	B. W. Tillmann [1]	1,050
Newton County, Mo.	do	December, 1915	A. T. Sweet [1]	1,250
Ripley County, Mo.	do	do	F. Z. Hutton [1]	1,220
Dawes County, Nebr.	University of Nebraska	September, 1916	R. R. Burn [1]	1,800
Polk County, Nebr.	do	November, 1915	J. M. Snyder [1]	1,100
Richardson County, Nebr.	do	December, 1915	A. H. Meyer [1]	1,350
Washington County, Nebr.	do	October, 1915	L. V. Davis [1]	1,050
Camden area, N. J.	New Jersey Experiment Station and New Jersey Geological Survey.	December, 1915	A. L. Patrick [1]	1,100
Schoharie County, N. Y.	New York State College of Agriculture.	do	E. T. Maxon [1]	1,320
Alleghany County, N. C.	North Carolina Department of Agriculture and North Carolina Experiment Station.	October, 1915	R. T. A. Burke [1]	1,250
Anson County, N. C.	do	November, 1915	E. S. Vanatta [1]	1,050
Davidson County, N. C.	do	January, 1916	R. B. Hardison [1]	1,600
Bottineau County, N. Dak.	North Dakota Experiment Station.	November, 1916	W. B. Cobb,[1] W. I. Watkins.[1]	1,900
Geauga County, Ohio.	Ohio Experiment Station.	October, 1915	C. N. Mooney [1]	1,050
Hamilton County, Ohio.	do	do	A. L. Goodman [1]	740
Miami County, Ohio.	do	do	John Woodward and other State representatives.	None.[2]
Kay County, Okla.		June, 1916	R. C. Jurney, N. M. Kirk.	3,550
Blair County, Pa.	Pennsylvania State College and Pennsylvania Experiment Station.	December, 1915	J. O. Veatch [1]	1,550
Cambria County, Pa.	do	June, 1916	B. B. Derrick [1]	1,720

[1] Assisted by State representative.

[2] Expenses paid by State.

SOIL SURVEY—DETAIL AREAS—Continued.

Location.	Cooperation.	Probable date of completion.	Assignment.	Proposed expenditures, 1915-16.
Windsor County, Vt.		June, 1916	G. B. Jones, J. A. Kerr.	$3,550
Fairfax County, Va.	Virginia Experiment Station.	November, 1915	W. T. Carter, jr	1,550
Benton County, Wash.	Washington Geological Survey.	November, 1916	A. E. Kocher [1]	3,575
Gilmer and Lewis Counties, W. Va.	West Virginia Geological Survey.	December, 1915	W. J. Latimer	1,175
Portage County, Wis.	Wisconsin Geological and Natural History Survey.	do	L. R. Schoenmann [2]	[3] 2,920
Rock County, Wis.	do	do	W. A. Rockie [2]	
Wood County, Wis.	do	do	do.[2]	
Total, detail surveys				63,140

SOIL SURVEY—RECONNOISSANCE AREAS.

Location.	Cooperation.	Probable date of completion.	Assignment.	Proposed expenditures, 1915-16.
San Joaquin Valley area, Cal.	University of California and California Experiment Station.	December, 1915	L. C. Holmes,[1] E. C. Eckmann.[1]	$3,490
South part of north-central Wisconsin.	Wisconsin Geological and Natural History Survey.	do	A. E. Taylor, J. B. R. Dickey.[2]	3,210
Total, reconnoissance surveys				6,700

DETAIL AND RECONNOISSANCE AREAS.

Winter and spring assignments, to be determined later	$62,200

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[1] Assisted by State representative.

[2] Four bureau employees have been assigned to Wisconsin for the summer season, working in both detail and reconnoissance areas, and will be assisted by four State representatives.

[3] For all Wisconsin detail work.

Reclamation Projects:

Object.—To classify certain lands in reclamation projects for the purpose of showing their adaptability for agricultural development under irrigation.

Cooperation.—Reclamation Service.

Location.—Vicinity of Montrose and Grand Junction. Colo., and other areas to be indicated by the Department of the Interior.

Date begun.—1915.

Assignment.—A. T. Strahorn.

Proposed expenditures, 1915-16.—$3,500.

Inspection of Field Work:

Object.—To inspect all work of the soil-survey field parties, examine and correct area reports, and prepare memoranda for soil correlation.

Location.—Headquarters, Washington, D. C.; much time spent in the field in inspection work.

Date begun.—1898.

Results.—Inspection of all areas surveyed during the past year, including correction of reports and preparation of correlation memoranda.

Assignment.—H. H. Bennett, W. E. Hearn, W. E. McLendon, M. H. Lapham, T. D. Rice.

Proposed expenditures, 1915-16.—$16,560.

Map Drafting:

Object.—Preparation of soil, alkali, and land-classification maps, both detail and reconnoissance; also page-plate illustrations; and securing map data in advance for field use.

Cooperation.—Other bureaus of the department and other departments.

Location.—Washington, D. C.

Date begun.—1898.

Map Drafting—Continued.

Results.—Have prepared and constructed base and soil maps; secured miscellaneous data for field and office use; adjusted traverse; plotted land-Office work and railroad and river surveys; compiled, redrawn, and colored from original field sheets and notes of the soil-survey parties maps to be used as copy in lithographic reproduction; verified names; measured the areas of the different soil types; prepared drawings for illustrating reports; wrote specifications for lithographic work and read proof furnished through the Public Printer.

Assignment.—Charles A. Drake.

Proposed expenditures, 1915–16.—$15,600.

Photographic Reproduction of Base Maps:

Object.—To enlarge or reproduce by photographic process base maps for use of soil-survey field parties and for the map-drafting force.

Location.—Washington, D. C.

Date begun.—1898.

Results.—Reproduced and mounted county maps for use in all soil-survey areas during the year, developed negatives, and made prints used in bureau reports.

Assignment.—R. J. Bonde.

Proposed expenditures, 1915–16.—$2,000.

Special Soil Studies:

Object.—To investigate the relation of soils to crops and prepare monographs on important soil series.

Location.—Washington, D. C., and in the field.

Date begun.—1911.

Results.—Studies made of the relation of soils to crops in central New Jersey, with especial reference to the Freehold, Hartford, Thoroughfare, and Dents areas, including partial preparation of reports; field studies of the Hagerstown soils between the Delaware and Roanoke Rivers.

Assignment.—J. A. Bonsteel.

Proposed expenditures, 1915–16.—$5,050.

Advisory Service:

Object.—To answer inquiries regarding soils and give advice as to their use.

Cooperation.—Other bureaus of the department.

Location.—Washington, D. C.

Date begun.—1913.

Results.—It is estimated that replies will have been made during the year to upwards of 1,200 inquiries regarding the use of soils.

Assignment.—J. E. Lapham.

Proposed expenditures, 1915–16.—$2,500.

Supplies:

Object.—To purchase instruments and supplies required for use in the soil-survey work.

Location.—Washington, D. C.

Date begun.—1898.

Proposed expenditures, 1915–16.—$2,700.

Total, Soil-Survey Investigations, $193,500.

[Research.]

CLASSIFICATION OF AGRICULTURAL LANDS IN FOREST RESERVES.

Forest-Land Classification:

Object.—To classify and segregate agricultural lands in the national forests.

Cooperation.—Forest Service.

Location.—The several forest reserves.

Date begun.—1912.

Results.—Twenty-seven projects examined and reports prepared and furnished the Forest Service in the following national forests: California—Angeles, Modoc, Shasta, and Sierra; Wyoming—Teton; Colorado—Pike and Routt; Montana—Blackfeet, Flathead, Custer, Deerlodge, Helena, Lolo, Lewis and Clark, and Missoula.

Assignment.—J. E. Dunn, H G. Lewis, Mark Baldwin.

Proposed expenditures, 1915–16.—$20,000.

BUREAU OF ENTOMOLOGY.

GENERAL ADMINISTRATION.

Office of Chief:

Object.—General administration, supervision, and direction of the investigations and business activities of the bureau.

Cooperation.—All the bureaus of the department, other executive departments, and State institutions.

Location.—Washington, D. C.

Date begun.—1879.

Assignment.—L. O. Howard.

Proposed expenditures, 1915–16.—$9,300.

Office of Chief Clerk:

Object.—The chief clerk is the executive officer of the bureau and is charged with carrying into effect the directions and policies of the chief, has general supervision of the clerical force, the messenger and janitor service, the care of offices, and the collation of records.

Location.—Washington, D. C.

Date begun.—1879.

Assignment.—E. B. O'Leary.

Proposed expenditures, 1915–16.—$8,610.

Accounts:

Object.—Supervision and maintenance of financial records of the bureau.

Location.—Washington, D. C.

Date begun.—1879.

Assignment.—A. J. Leister.

Proposed expenditures, 1915–16.—$9,700.

Library:

Object.—To conduct work incidental to the maintenance of a library of entomological literature.

Location.—Washington, D. C.

Date begun.—1879.

Assignment.—Mabel Colcord.

Proposed expenditures, 1915–16.—$3,000.

Supplies:

Object.—The purchase, custody, distribution, and record of all equipment and materials for field and office use.

Location.—Washington, D. C.

Date begun.—1879.

Assignment.—B. S. Walker.

Proposed expenditures, 1915–16.—$4.540.

Editorial Work:

Object.—To conduct the editorial work of the bureau and facilitate the publication of the results of entomological investigations.

Location.—Washington, D. C.

Date begun.—1879.

Assignment.—B. A. Reynolds.

Proposed expenditures, 1915–16.—$2,300.

Files and Records:

Object.—The filing of all correspondence pertaining to the operations of the bureau.

Location.—Washington, D. C.

Date begun.—1879.

Assignment.—T. A. Keleher.

Proposed expenditures, 1915–16.—$1,400.

Total, General Administration, $38.850 (research, $35,350; regulation, $3.490).

[Research.]

DECIDUOUS-FRUIT INSECT INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—To plan and direct the activities relating to deciduous-fruit insect investigations, including supervision of scientfic work, general office routine, correspondence, etc.

Location.—Washington, D. C.

Date begun.—1905.

Assignment.—A. L. Quaintance.

Proposed expenditures, 1915–16.—$7,748.

APPLE INSECT INVESTIGATIONS.

Apple-Tree Borers:

Object.—To determine the life histories and habits of the various species of apple-tree borers and to develop appropriate remedies therefor.

Procedure.—Extensive investigations in orchards are made to determine species of troublesome borers and the amount of injury resulting from their work. Insects are collected and reared in the field laboratory and observations made on their life history, habits, etc. Laboratory observations are checked by extended observations in the field. Remedial measures are undertaken based on knowledge of the behavior of the insect. The work will be extended to include all important species of borers, with a view to furnishing a comprehensive account of these insects as a class.

Location.—French Creek, W. Va.

Date begun.—1911.

Results.—The biology of several species of borers has been worked out and other species are under investigation. Many preparations have been and are being tested as remedies, some of which are effective in preventing infestation by certain species. Work on the round-headed apple-tree borer has been completed and a manuscript submitted for publication.

Probable date of completion.—1917.

Assignment.—Fred E. Brooks.

Proposed expenditures, 1915–16.—$2,551.

Apple Plant Lice:

Object.—To determine the life histories of and remedies for apple plant lice, such as the woolly apple aphis, green apple aphis, rosy apple aphis, etc.

Procedure.—Careful biological studies of these insects are made in the laboratory, especially to determine the character of injury, number of generations, host plants, manner of wintering, etc. Remedial investigations are undertaken in the field to determine the most effective sprays and times when applications should be made, as, in winter, for the destruction of the eggs, and, in early spring, for the destruction of newly hatched insects, and to determine the possibilities of control by the use of aphiscides in combination with other sprays. Future work on this project will include a study of other species of orchard plant lice.

Location.—Vienna and Winchester, Va.

Date begun.—1912.

Results.—The biology of the woolly apple aphis has been thoroughly worked out and a publication already issued (Report 101, Office of Secretary). Studies of the life history of the green apple aphis have also been finished and a report is now in manuscript form. Work is now in progress on other important species, as the rosy apple aphis, etc. Experiments in orchards with sprays indicate effective control by the timely use of these, especially nicotine sprays.

Probable date of completion.—1918.

Assignment.—A. C. Baker, W. F. Turner, B. R. Leach.

Proposed expenditures, 1915–16.—$6,040.

Codling Moth:

Object.—To determine what variations are necessary in spraying schedules to control the codling moth in widely separated fruit districts, such as Maine, Arkansas, Michigan, New Mexico, California, Colorado, the Allegheny region, etc.

Procedure.—Field laboratories are established in important apple-growing regions, representing essentially different climatic and other conditions. The biology of the codling moth is thoroughly investigated, especially as bearing on the question of its control in orchards. Extensive field experiments are carried out to determine the comparative value of the respective spray treatments, the most effective quantity of poison to be employed, and similar questions of practical importance. The work will be extended to one or two additional apple-growing sections in the United States, which will complete the project.

Cooperation.—Colorado Experiment Station.

Location.—Roswell, N. Mex.; Grand Junction, Colo.

Date begun.—1908.

Results.—Work has been completed in Michigan, Pennsylvania, Arkansas, the Allegheny region, and California, and reports have been issued for these regions. A report is now in press on the codling moth in Maine.

Probable date of completion.—1918.

Assignment.—E. H. Siegler, E. W. Geyer, R. J. Fiske.

Proposed expenditures, 1915-16.—$7,150.

Relation of Insects to Stigmonose:

Object.—To determine the relation of insects, especially hemipterous insects, to the affection of apples known as stigmonose.

Procedure.—Thorough search is made in orchards for insects likely to be associated with stigmonose trouble. These insects are brought to the laboratory and studied under exact conditions. Numerous species of hemiptera, especially plant lice, are under observation, and the inquiry will be extended to all species which, from their habits, are likely to be concerned.

Cooperation.—Bureau of Plant Industry.

Location.—Wenatchee, Wash.

Date begun.—1914.

Results.—Work not under way sufficiently long to warrant statements as to results.

Probable date of completion.—1916.

Assignment.—E. J. Newcomer.

Proposed expenditures, 1915-16.—$2,415.

Total, Apple Insect Investigations, $18,156.

PEACH INSECT INVESTIGATIONS.

Peach Borer and Miscellaneous Peach Insects:

Object.—To determine the life history and habits of the peach-tree borer and other peach insects and to develop appropriate remedies therefor.

Procedure.—The biology of the peach borer is investigated in orchards and in the laboratory, and experiments with remedies are conducted on a large scale in orchards. In connection with this work other peach insects, such as the plum curculio, peach-twig borer, etc., are studied and experiments in their control made. The work eventually is to cover all of the more important peach insects in the United States.

Location.—Winchester, Va., and Washington, D. C.

Date begun.—1911.

Results.—The biology, food plants, etc., of the peach borer have been pretty well determined for different parts of the country where peaches are grown. Numerous washes and practices recommended for its control have been tried, many of which have been found to be without value. Experiments now under way give promise of developing a successful treatment.

Assignment.—E. B. Blakeslee, W. B. Wood.

Proposed expenditures, 1915-16.—$4,540.

GRAPE INSECT INVESTIGATIONS.

Grape Phylloxera:

Object.—To determine the life history of the grape Phylloxera under California conditions, means of dispersal, comparative resistance to Phylloxera of different varieties of grapes, and possibilities of renovation of old infested vineyards.

Procedure.—The biology of the grape Phylloxera is carefully studied, especially as bearing on the question of its control in vineyards. Extensive experiments are being carried out in vineyards to determine the best remedial measures to be employed. The possibility of renovating old infested vineyards is also under investigation.

Cooperation.—Bureau of Plant Industry (varietal resistance).

Location.—Walnut Creek, Cal.

Date begun.—1912.

Results.—Biological studies of Phylloxera are pretty well completed, and a report on this phase of the work is in preparation. A large amount of data on the success of aphid colonies on roots of different varieties of grapes has been accumulated. Experiments in renovating Phylloxera-infested vineyards thus far made indicate much benefit from the methods employed.

Probable date of completion.—1916.

Assignment.—R. L. Nougaret, W. M. Davidson.

Proposed expenditures, 1915–16.—$4,950.

Grape Berry Moth and Miscellaneous Grape Insects:

Object.—To determine the life history and habits of the grape berry moth and other important insects affecting the grape; to develop remedies for their control.

Procedure.—The biology of the grape berry moth is carefully studied as a basis for the control of this insect in vineyards. Extensive spraying and other experiments are carried on in vineyards to determine the best remedial measures to be employed. In connection with this work other important grape insects are being investigated.

Location.—North East, Pa.

Date begun.—1907.

Results.—Many data on the biology of the grape berry moth have been obtained and a publication issued. The life histories and habits of several important grape pests have been determined, effective remedies developed, and publications issued.

Probable date of completion.—1918.

Assignment.—Dwight Isely.

Proposed expenditures, 1915–16.—$2.191.

Total, Grape Insect Investigations, $7,141.

NUT INSECT INVESTIGATIONS.

Pecan Insects:

Object.—To determine the biologies of and remedies for the principal pecan and other nut insects.

Procedure.—Careful biological studies are made of the more important pecan and other nut insects, and experimental work in pecan groves is carried out.

Location.—Monticello, Fla.

Date begun.—1913.

Results.—A large amount of data on important pecan insects has been accumulated. A manuscript on some of these has been prepared for publication. Experiments with sprays applied with high-power sprayers show the practicability of this work in many instances. The work will be extended to include the more important insect pests of other nuts, such as the walnut, chestnut, etc.

Probable date of completion.—1918.

Assignment.—John B. Gill, A. I. Fabis.

Proposed expenditures, 1915–16.—$4.130.

INVESTIGATIONS OF ORCHARD INSECTICIDES AND SPRAYING MACHINERY.

Orchard and Miscellaneous Insecticides:

Object.—To determine the comparative value of insecticides in general use and to what extent they may be combined with different fungicides in the control of insect plant pests; to develop new insecticides and determine their value in insect control and their effect on the insects and plants treated.

Procedure.—Numerous insecticides are tested under laboratory and field conditions against different species of insects alone and in combination with fungicides. Experimental work is carried on in combining chemicals to form new insecticides. Before recommendations can be made such insecticides must be fully tested, in order to determine their efficiency against insects and their action on plant life when used alone and when in combination with fungicides.

Cooperation.—Bureaus of Plant Industry and Chemistry.

Location.—Benton Harbor, Mich., and Washington, D. C.

Date begun.—1912.

Results.—Orchard tests have been made of many types of commercial insecticides to determine their relative merits. New commercial insecticides are tested as far as practicable, as they appear from year to year, for the information of the department. Feeding experiments have been made with many toxic substances, to determine their usefulness as insecticides, and a publication on the subject will shortly be issued.

Assignment.—A. L. Quaintance, F. L. Simanton, H. G. Ingerson.

Proposed expenditures, 1915–16.—$5,320.

Spraying Apparatus and Spraying Efficiency:

Object.—To investigate the relative efficiency of spraying apparatus, noting especially principles of construction, types of gasoline motors, pumps, etc.

Procedure.—The relative efficiency of the many types of spraying apparatus now on the market will be investigated in orchards and factories. Attention will be given to determine the durability of materials used in pumps as affected by various spray liquids, methods of packing valves, and other practical points. An estimate will also be made of spraying efficiency as practiced by various orchardists, vineyardists, etc., as a basis for suggestions for improvements in such work.

Cooperation.—Bureau of Plant Industry and Office of Public Roads and Rural Engineering.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Work has not been under way sufficiently long to warrant statements regarding results.

Assignment.—A. L. Quaintance.

Proposed expenditures, 1915–16.—$2,000.

Total, Investigations of Orchard Insecticides and Spraying Machinery, $7,320.

CRANBERRY AND SMALL-FRUIT INSECT INVESTIGATIONS.

Cranberry and Small-Fruit Insect Investigations:

Object.—To study insects affecting the cranberry and other small fruits, such as the currant, huckleberry, blueberry, etc., and to develop effective control measures.

Procedure.—Work at present is confined largely to the cranberry. Careful biological studies are made of the injurious insects of this crop, especial attention being paid to their seasonal history in bogs, places of hibernation, etc. Experiments with insecticides are in progress to determine the best remedial measures, and observations on such practices as sanding bogs and reflooding after the bogs have been drained in the spring are also being made.

Location.—Pemberton, N. J.

Date begun.—1913.

Results.—A large amount of data has been accumulated on the important cranberry insects in New Jersey and the effectiveness of flooding bogs and other control methods employed. Improvement has been effected in insecticidal sprays used. A report on the cranberry insects of Wisconsin is ready for publication.

Cranberry and Small-Fruit Insect Investigations—Continued.

Probable date of completion.—1918.

Assignment.—H. B. Scammell, H. K. Plank.

Proposed expenditures, 1915–16.—$3,420.

CONTROL OF DECIDUOUS-FRUIT INSECTS BY NATURAL AGENCIES.

Control of Deciduous-Fruit Insects by Natural Agencies:

Object.—To determine the importance of hymenopterous parasites in the control of deciduous-fruit insect pests, and, if possible, devise methods for their practical propagation and dissemination.

Procedure.—Parasitized insects are collected from various localities and sent to the laboratory at North East, Pa., for the rearing of parasites. The life histories and habits of parasites are worked out and efforts made to effect their propagation in quantity for dissemination.

Location.—North East, Pa.

Date begun.—1911.

Results.—Biological data have been obtained on several important parasites of deciduous-fruit insects as a basis for their intelligent propagation. Many new parasites have been discovered and their economic status determined. Special attention has been given to the parasites of the grape berry moth and several species are being studied in detail.

Assignment.—R. A. Cushman.

Proposed expenditures, 1915–16.—$2,100.

DECIDUOUS-FRUIT NURSERY INSECT INVESTIGATIONS.

Deciduous-Fruit Nursery Insect Investigations:

Object.—To investigate the various insects affecting nursery stock and to develop remedies which may be effectively applied under nursery conditions; to investigate the efficiency of fumigation methods now employed by nurserymen and to effect improvements in disinfecting nursery stock.

Procedure.—Careful studies are made of all important insect enemies of nursery stock and remedies developed which may be applied under nursery conditions; observations are made on methods of fumigation now practiced by nurserymen, the efficiency of this work, and effect on the plants treated.

Location.—West Chester, Pa.

Date begun—1914.

Results.—Work has not been under way sufficiently long to warrant statements concerning results.

Assignment.—A. J. Ackerman.

Proposed expenditures, 1915–16.—$2,000.

ORCHARD INSECT SURVEY.

Orchard Insect Survey:

Object.—To obtain information on the large number of insect pests of orchards, vineyards, etc., at present of lesser importance in the United States, but which may become important at any time.

Procedure.—Insect outbreaks of a serious nature are investigated and information obtained on conditions responsible for such outbreaks. Insects are collected in orchards, vineyards, etc., and a good many are obtained through correspondence. Necessary records and photographs and drawings of insects and of plant specimens showing injury are made, to be used in publications and for reference purposes.

Location.—Washington, D. C.

Date begun.—Work of this character has been in progress for many years.

Results.—A large amount of information has been accumulated on miscellaneous insects of the orchard, vineyard, etc., in the United States. Specimens of these are in the collection for use in making drawings and descriptions. A large collection of notes and photographs is already on file and is being rapidly enlarged.

Assignment.—J. H. Paine, J. F. Strauss.

Proposed expenditures, 1915–16.—$4,245.

Total, Deciduous-Fruit Insect Investigations, $60,800.

[Research.]

CEREAL AND FORAGE INSECT INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—To plan and direct the activities relating to cereal and forage insect investigations, including supervision of scientific work, general office routine, correspondence, etc.
Location.—Washington, D. C.
Date begun.—1904.
Assignment.—F. M. Webster.
Proposed expenditures, 1915–16.—$7,000.

CEREAL INSECT INVESTIGATIONS.

Hessian Fly:

Object.—To study the life history, development, and distribution of the parasites of the Hessian fly, in order that their services may be artificially utilized more intelligently; to determine the cause of the nonoccurrence of the Hessian fly under agricultural conditions that would seem to favor its development; to determine varieties of grain least subject to attack.
Procedure.—The work consists chiefly of field experiments, small plats of wheat being sown every 10 days in the fall, extending over a period of two or three months, in all States where this pest is destructively abundant.
Cooperation.—University of South Carolina.
Location.—Eastern United States and middle United States.
Date begun.—1905.
Results.—Progress has been made to such an extent in the investigation of the relationship between meteorological conditions and the occurrence of the principal Hessian-fly parasites that it is now possible to forewarn farmers against a threatened outbreak; sufficient information has also been obtained to enable farmers to so time their wheat sowings in the fall, during seasons of normal precipitation, as to escape fall attacks of this pest.
Probable date of completion.—1917.
Assignment.—E. O. G. Kelly, W. R. McConnell, C. N. Ainslie.
Proposed expenditures, 1915–16.—$5,000.

Dipterous Enemies of Grains Other than the Hessian Fly:

Object.—To determine accurately other species of fly attacking wheat and other grains whose ravages are wrongly charged to the Hessian fly and to devise preventive measures directed more definitely against such pests.
Procedure.—This project is conducted in essentially the same manner as are the Hessian-fly investigations.
Location.—Various points throughout the grain-growing sections of the United States.
Date begun.—1884.
Results.—It has been found that many dipterous species which were once supposed to be native to America are of European origin and that these species have long been injurious to grains in the British Islands, western Europe, and western Asia.
Probable date of completion.—1918.
Assignment.—W. R. McConnell, E. O. G. Kelly, C. N. Ainslie.
Proposed expenditures, 1915–16.—$4,500.

Cutworms:

Object.—To investigate the life history and habits of all species of cutworms in the United States affecting corn and grass, together with their parasites and other natural enemies.
Procedure.—The diverse habits of the various species of cutworms make it necessary that each species be studied separately over its entire area of distribution, and this is accomplished by means of extensive field studies and laboratory investigations.
Location.—Temporary and other field stations throughout the United States.
Date begun.—1912.
Results.—Progress has been made in the study of a number of species, notably such as have evidently crossed the border from Mexico and

Cutworms—Continued.

occur only in the extreme southern section of the country. Efficient methods of control have been found, except in the case of the western army cutworm and one or two other species.

Assignment.—F. M. Webster.

Proposed expenditures, 1915–16.—$3,500.

Corn-Leaf Aphis:

Object.—To determine the relation of the corn-leaf aphis (*Aphis maidis*) to other similar species; methods of control, especially along the southern border of the country, where, instead of attacking corn, as in the North, it attacks and destroys young growing barley, in some localities preventing the cultivation of that crop.

Procedure.—This project is conducted by means of laboratory experiments, field work in small laboratory plats, and finally by means of field experimentation on selected farms.

Location.—Brownsville, Tex.; Nashville, Tenn.; Tempe, Ariz.

Date begun.—1911.

Results.—It has been found that this pest, once supposed to limit its depredations to corn, also works in young barley in some sections of the country; also that it winters in the extreme southern portion of the country, gradually making its way northward with the advance of the season.

Probable date of completion.—1917.

Assignment.—R. A. Vickery, G. G. Ainslie, V. L. Wildermuth.

Proposed expenditures, 1915–16.—$3,000.

Fungous Enemies of the Chinch Bug:

Object.—To determine whether fungous enemies can be used artificially to advantage in overcoming an invasion of the chinch bug.

Procedure.—Consists chiefly of laboratory experiments looking to the propagation of the fungous diseases, followed by field experimentation with infested insects.

Location.—Wellington, Kans., and Salt Lake City, Utah.

Date begun.—About 1887.

Results.—A vast amount of material has been secured, consisting of young chinch bugs that have been exposed during different periods to infection by Sporotrichum; other stages of the insect have been similarly exposed, the material preserved, and sections of a part of it made. Much still remains to be done.

Probable date of completion.—1917.

Assignment.—E. O. G. Kelly, L. W. Rockwood.

Proposed expenditures, 1915–16.—$3,500.

Mechanical Destruction of Hibernating Chinch Bugs:

Object.—To determine the efficiency of burning grass during winter and early spring and other mechanical methods of destroying hibernating chinch bugs and of preventing the migration of these insects from one field to another.

Procedure.—Careful experiments are conducted to determine the best methods of handling the margins of fields where these pests hibernate, with burning and other experiments designed to destroy them while in hibernation.

Location.—Wellington, Kans.; Lafayette, Ind.; Charleston, Mo.

Date begun.—1911.

Results.—Enough progress has been made to show that invasions of chinch bugs may in all probability be prevented by the careful and systematic burning of certain dead vegetation during the early winter. Farmers' Bulletin 657 deals to some extent with this phase of the chinch-bug investigations.

Probable date of completion.—1917.

Assignment.—E. O. G. Kelly, J. J. Davis, E. H. Gibson.

Proposed expenditures, 1915–16.—$2.100.

Western Corn Rootworm:

Object.—To find some practical means of preventing the corn rootworm in sections subject to the annual overflow of streams.

Procedure.—Both laboratory and field experiments are conducted, the latter being in many instances in cooperation with farmers.

Western Corn Rootworm—Continued.

Location.—Nashville, Tenn.; Lafayette, Ind.; Elk Point, S. Dak.

Date begun.—1912.

Results.—The pest has been traced throughout the bottom lands along rivers of Kentucky and Tennessee, where it was not previously supposed to exist. Department Bulletin 5 has been published on this project.

Probable date of completion.—1918.

Assignment.—G. G. Ainslie, J. J. Davis, C. N. Ainslie.

Proposed expenditures, 1915–16.—$2,250.

Southern Corn Rootworm:

Object.—To devise methods for protecting the corn crop in the Southern States from the ravages of the rootworm.

Procedure.—A careful study of the life history of this species is being made by laboratory experimentation, and field experiments are being carried out on a small scale.

Cooperation.—University of South Carolina and University of Florida.

Location.—Nashville, Tenn.; Charleston, Mo.; Gainesville, Fla.; Columbia, S. C.

Date begun.—1913.

Results.—Considerable progress has been made toward curtailing the damage by this pest by advising the planting of corn in spring at such a time as to bring the plants above ground after the females have deposited their eggs, the date of planting varying, of course, according to latitude. Data in Department Bulletin 5.

Probable date of completion.—1917.

Assignment.—G. G. Ainslie, E. H. Gibson, R. N. Wilson, Philip Luginbill.

Proposed expenditures, 1915–16.—$4,000.

Colorado Corn Rootworm:

Object.—To study the life history and natural diffusion of the species and the conditions under which it may attack growing corn; to ascertain the difference in the work of this insect and that of closely allied species; and to find out whether the same methods of suppression are applicable to its control.

Procedure.—The methods by which this investigation is carried on are substantially the same as those which are in use in the investigations of the western and southern corn rootworms.

Location.—Maxwell, N. Mex., and Charleston, Mo.

Date begun.—1913.

Results.—Much has been learned as to the distribution of this insect and as to its habits of larval attack.

Probable date of completion.—1916.

Assignment.—D. J. Caffrey, E. H. Gibson.

Proposed expenditures, 1915–16.—$750.

Wireworms:

Object.—To determine the different species of wireworms attacking grain and forage crops, their habits and life history, the most favorable conditions for their development, and methods of control.

Procedure.—Each species is carefully studied under laboratory conditions and these results checked by field experiments conducted under conditions like those experienced by the farmer in combating the pest.

Location.—Hagerstown, Md.; Charleston, Mo.; Gainesville, Fla.; West Springfield, Mass.

Date begun.—1911.

Results.—Data in Farmers' Bulletin 543.

Probable date of completion.—1918.

Assignment.—J. A. Hyslop, E. H. Gibson, R. N. Wilson, Harrison E. Smith.

Proposed expenditures, 1915–16.—$4,600.

Control of Diabrotica Balteata:

Object.—To determine the extent to which this pest is liable to become diffused northward from Texas and to devise measures for restricting or eliminating its ravages.

Procedure.—Close observations are made in cage experiments in the laboratory and in small out-of-door experiments; the results of these experiments are then applied on a larger scale in field plats.

Location.—Brownsville, Tex.

Control of Diabrotica Balteata—Continued.

Date begun.—1912.

Results.—Considerable material is now on hand, which it is hoped to embody later in a publication dealing with this pest.

Probable date of completion.—1916.

Assignment.—R. A. Vickery.

Proposed expenditures, 1915–16.—$500.

Native Species of White Grub:

Object.—To destroy or prevent the appearance of white grub (Lachnosterna) larvæ in fields; to determine the identity of parasites and the extent to which such natural enemies may be artificially utilized; to determine the life cycle of the various species; and to discover whether or not this pest can be successfully combated by definite systems of crop rotation designed to hold it in check.

Procedure.—The leader of this project visits various sections of the country where the larvæ or grubs occur in destructive abundance, studying the nature of the soil, topography of the country, and the nature of the forest flora which is most likely to produce food for the adult beetle. Collections are made at the time of plowing the infested fields and this information is studied with relation to previous systems of crop rotation.

Cooperation.—State entomologist of Illinois and Government entomologist of the Dominion of Canada.

Location.—Lafayette, Ind.; Charlottesville, Va.; Hagerstown, Md.; Wellington, Kans.

Date begun.—1911.

Results.—Farmers' Bulletin 543 embodies a portion of the results of this investigation, although considerable information has been acquired and tabulated since the issuance of that publication.

Probable date of completion.—1919.

Assignment.—J. J. Davis, W. J. Phillips, J. A. Hyslop, E. O. G. Kelly.

Proposed expenditures, 1915–16.—$11,500.

Jointworms:

Object.—To establish the identity of each of the grain or grass infesting species and their relationship to each other; to determine the area of distribution of the at present supposed species; to investigate methods of control, including studies of natural enemies.

Procedure.—The various species are artificially reared in laboratory experiments from their native wild grasses, and field tests are then made to see if the pest will forsake its natural food plant to attack cultivated grains and grasses.

Location.—Charlottesville, Va.; Elk Point, S. Dak.; Charleston, Mo.

Date begun.—1911.

Results.—Considerable progress has been made in separating the different forms and studying their relation to the grains and grasses which they inhabit.

Probable date of completion.—1916.

Assignment.—W. J. Phillips, C. N. Ainslie, E. H. Gibson.

Proposed expenditures, 1915–16.—$3,600.

Sod Webworms:

Object.—To study the life history, habits, and natural enemies of these moths and their larvæ in connection with the cultivation of cereals throughout the United States.

Procedure.—The life history and habits of this species are being minutely studied by means of cage experiments in the laboratory and out of doors. These are supplemented by field experiments conducted under actual field conditions.

Location.—Nashville, Tenn.; Charlottesville, Va.; Hagerstown, Md.; West Springfield, Mass.

Date begun.—1913.

Results.—Considerable material is now on hand, which it is hoped, in time, to embody in a Farmers' Bulletin.

Probable date of completion.—1918.

Assignment.—G. G. Ainslie, W. J. Phillips J. A. Hyslop, Harrison E. Smith.

Proposed expenditures, 1915–16.—$4,000.

Fall Army Worm:

Object.—To investigate the life history, areas of perpetual habitation, and the natural enemies of this pest; to devise methods of control in the South, in order to prevent destructive invasions such as occurred in 1912.

Procedure.—This project is being conducted by means of extensive field observations and experiments, wherein this pest is carefully studied with special reference to its parasitic enemies.

Location.—Brownsville, Tex.; Columbia, S. C.; Gainesville, Fla.; Greenwood, Miss.; Nashville, Tenn.

Date begun.—1912.

Results.—It has been found that this species does not winter extensively outside of Florida and extreme southern Texas and that, if it is controlled during the winter and early spring by its natural enemies in those regions, no invasion to the northward during that season will occur.

Probable date of completion.—1917.

Assignment.—R. A. Vickery, Philip Luginbill, R. N. Wilson, C. F. Turner, G. G. Ainslie.

Proposed expenditures, 1915–16.—$8,000.

False Wireworms:

Object.—To study the life history and habits of false wireworms affecting growing grain and devise methods for their control.

Procedure.—Similar to that adopted in investigating wireworms.

Location.—Wellington, Kans., and Maxwell, N. Mex.

Date begun.—1911.

Results.—Many species are being investigated; results in some cases will soon be ready for publication.

Probable date of completion.—1917.

Assignment.—E. O. G. Kelly, D. J. Caffrey.

Proposed expenditures, 1915–16.—$1,000.

Miscellaneous Cereal Insects:

Object.—To investigate sporadic or periodic outbreaks of insects that may attack cereal crops in the field and any other cereal-infesting insects whose sudden appearance in unusual numbers may require immediate investigation; also to investigate such other cereal insects as may not heretofore have been known as destructive.

Date begun.—1910.

Results.—Much valuable information has been obtained and considerable assistance rendered to farmers in times of imperative need, such as, for instance, the unexpected grasshopper outbreak of 1914.

Proposed expenditures, 1915–16.—$1,000.

Total, Cereal Insect Investigations, $62,800.

FORAGE INSECT INVESTIGATIONS.

Alfalfa Seed Chalcis:

Object.—To study the life history of the insect and determine some practical method of preventing the large percentage of loss of clover and alfalfa seed due to chalcis; to conduct life-history studies of native parasites of the alfalfa and clover-seed chalcis, with a view to controlling the pest.

Procedure.—Careful laboratory investigations with the insect and its parasites, checked by field observations.

Location.—Pasadena, Cal.; Tempe, Ariz.; Forest Grove, Oreg.

Date begun.—1912.

Results.—A large number of life-history studies and cultural experiments have been carried out, but some complications have developed which render progress rather slow. A large number of parasites have been reared and studied with relation to their host insect, most of them being new to science. Matter will soon be ready for publication.

Probable date of completion.—1918.

Assignment.—Theodore D. Urbahns, V. L. Wildermuth, C. W. Creel.

Proposed expenditures, 1915–16.—$13,000.

Insects Affecting the Production of Clover Seed:

Object.—To carry on life-history studies of the clover-seed chalcis, which affects both clover and alfalfa, and investigate various other insects affecting clover seed, including a study of insect fertilization of the bloom.

Procedure.—Mode of procedure similar to that followed in investigating the alfalfa-seed chalcis.

Location.—Forest Grove, Oreg.; College Park and Hagerstown, Md.; West Springfield, Mass.

Date begun.—1911.

Results.—A considerable variation in habit has been discovered as between the arid West and the more humid regions of the eastern United States. A large number of parasites have been reared, many new to science.

Probable date of completion.—1918.

Assignment.—C. W. Creel, A. B. Gahan, J. A. Hyslop, H. E. Smith.

Proposed expenditures, 1915–16.—$6,000.

Insects Affecting Soy Beans:

Object.—To study the life history and habits of insects affecting this crop, which is constantly increasing in importance.

Procedure.—This project is conducted by means of laboratory and out-of-door breeding experiments, the results of such experiments being then checked up by careful field application.

Location.—Charlottesville, Va.; Columbia, S. C.; Greenwood, Miss.; Hagerstown, Md.; Charleston, Mo.

Date begun.—1912.

Results.—This project has not been in operation for a sufficient length of time to yield definite results, although a great variety of insects has been reared from soy beans, indicating in some measure the pests which will have to be combated in growing this crop.

Probable date of completion.—1919.

Assignment.—W. J. Phillips, Philip Luginbill, C. F. Turner, W. R. McConnell, E. H. Gibson.

Proposed expenditures, 1915–16.—$3,100.

Range Caterpillar:

Object.—To determine methods of eradicating the insect during its different stages of development; to experiment with parasites and other predaceous insects and with mechanical devices for the destruction of this pest.

Procedure.—Life-history studies of the insect have been made by means of cage experiments and field observations; observations and experiments with native and imported parasites of this pest are carried on in cages and in the field, and various mechanical devices are being tested.

Location.—Maxwell, N. Mex., and College Park, Md.

Date begun.—1913.

Results.—A large quantity of field notes has been collected and tabulated, but it is yet too early to report definite results.

Probable date of completion.—1917.

Assignment.—D. J. Caffrey, A. B. Gahan.

Proposed expenditures, 1915–16.—$4,000.

Alfalfa Weevil:

Object.—To colonize and study the life history and habits of insect and fungous enemies of the alfalfa weevil; to determine the efficiency of cultivation and irrigation, either combined or independently, as a practical means of weevil control; to determine the extent of increase in territory covered by the weevil during recent years.

Procedure.—This investigation is carried on through two field stations and by field experiments conducted in conjunction with these stations.

Cooperation.—Entomologist of the State of Utah.

Location.—Salt Lake City, Utah, and College Park, Md.

Date begun.—1910.

Results.—Twenty-five per cent of the larvæ subjected to the attack of a foreign parasite were infested; substantial progress has been made in the use of mechanical means of control.

Assignment.—G. I. Reeves, P. H. Timberlake, A. B. Gahan.

Proposed expenditures, 1915–16.—$15.500.

Insects Affecting Cowpeas:

Object.—To collect information relative to all insects attacking cowpeas, either above or below ground; to determine the influence on the fertilizing value of the plants of the attacks of larvæ on the nitrogenous nodules of the roots.

Procedure.—Methods of investigation similar to those adopted for the investigation of soy-bean insects.

Location.—Charlottesville, Va.; Columbia, S. C.; Greenwood, Miss.; Hagerstown, Md.; Charleston, Mo.

Date begun.—1912.

Results.—It has been found that the most destructive stage of some of these insects is the larval stage, at which time the attacks materially injure the nitrogenous nodules of the plants.

Probable date of completion.—1918.

Assignment.—W. J. Phillips, Philip Luginbill, C. F. Turner, W. R. McConnell, E. H. Gibson.

Proposed expenditures, 1915–16.—$4,100.

Miscellaneous Forage Insects:

Object.—To investigate outbreaks of miscellaneous insects as occasion may require when attacking any crop utilized as forage, whether such insects are destructively abundant or not.

Date begun.—1910.

Results.—Much general information, valuable in all lines of forage insect investigation or forage-crop cultivation, has been acquired by these miscellaneous investigations.

Proposed expenditures, 1915–16.—$2,000.

Total, Forage Insect Investigations, $47,700.

Total, Cereal and Forage Insect Investigations, $117,500.

[Research.]

SOUTHERN FIELD-CROP INSECT INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—To direct and supervise the expenditures of the appropriations for southern field-crop insect investigations.

Location.—Washington, D. C.

Date begun.—1909.

Assignment.—W. D. Hunter, W. D. Pierce.

Proposed expenditure, 1915–16.—$7,500.

COTTON INSECT INVESTIGATIONS.

Cotton Boll Weevil:

(*a*) Control in Severely Injured Sections—

Object.—To relieve the present situation in the Mississippi Valley, where cultural methods of controlling the boll weevil have been of comparatively little value, and also furnish relief in other sections where the damage is very severe.

Procedure.—This problem will be approached by experiments in the methods of cultivation, use of poisons, gathering of infested buds and fruit, rotations, parasite releases, experiments in fall destruction, and all other means of promise until the proper means of control in these sections can be perfected.

Cooperation.—Bureau of Plant Industry and Louisiana and Mississippi experiment stations.

Location.—Tallulah, La.

Date begun.—1895, in Texas; 1904, in Louisiana; 1910, in Mississippi.

Results.—In western Louisiana the control of the boll weevil has brought acreage yields back to almost normal. In the Mississippi Delta the work of the last five years has given increased confidence to the planters. On one very large plantation, where the bureau's methods have been followed intelligently, the boll-weevil damage has been reduced to a much lower amount than on any plantations in the vicinity where the bureau

Cotton Boll Weevil—Continued.

(*a*) CONTROL IN SEVERELY INJURED SECTIONS—Continued.

methods have been ignored. A measure of success has been obtained in the experiments with powdered arsenate of lead, but it remains necessary to ascertain the exact conditions under which this poison can be applied profitably.

Assignment.—B. R. Coad.

Proposed expenditures, 1915–16.—$8,850.

(*b*) LIFE-HISTORY STUDIES—

Object.—To determine the extent to which the weevil has changed its habits during the period it has existed in this country and to study it under native conditions. In connection with the new Arizona cotton industry, studies of the adaptability of the weevil to the greater severities of Arizona climate and comparison with Texas and Louisiana results will be made, with a view to working out climatic laws of behavior.

Procedure.—In Louisiana the life-history studies will be very carefully conducted on all phases of the weevil's development and resistance to external conditions. These experiments continue a series started on the establishment of the Tallulah laboratory. At Victoria and Uvalde, Tex., less important biological studies will be continued to check up with former records. At Tucson, Ariz., the weevil will be studied in its native condition. At Washington, D. C., experiments will be conducted in the retardation of development, in order to ascertain the climatic laws of behavior.

Location.—Tallulah, La.; Victoria and Uvalde, Tex.; Tucson, Ariz.; and Washington, D. C.

Date begun.—1904.

Results.—New studies of 1913–14 in Texas and Arizona have indicated the ability of the weevil to live on food plants other than cotton and to withstand greater severities of climate. These studies have also yielded sufficient information to form a tentative law of climatic control.

Assignment.—W. D. Pierce, B. R. Coad.

Proposed expenditures, 1915–16.—$3,500.

(*c*) STATUS AND DISTRIBUTION—

Object.—To determine prospects for damage early in the season, investigate reports of serious damage and new infestation, determine extent of spread and actual losses during the season, and map area of infestation, distribute warnings of future damage, and maintain quarantine.

Procedure.—Inspection trips are made throughout the year to all infested sections. The dispersion of the weevil is ascertained during the months of September to December by a thorough investigation of the entire outside limits of the weevil infestation.

Cooperation.—State entomologists of Georgia, Alabama, Florida, Mississippi, Tennessee, Arkansas, Oklahoma, Louisiana, Texas, and Arizona, and demonstration agents of the States Relations Service.

Location.—All sections of the cotton belt where the weevil occurs or is reported to occur.

Date begun.—1892.

Results.—By means of the information secured through this service a quarantine against artificial distribution has been obtained which has efficiently prevented a natural spread in several cases, and sporadic occurrence outside of the main infested area has been stopped. The statements issued have been instrumental in determining the course of action of many planters and business men.

Assignment.—W. D. Pierce.

Proposed expenditures, 1915–16.—$2,500.

Cotton Root Aphides:

Object.—To determine means of control.

Procedure.—A thorough study is being made of the life history, food plants and control of species of aphis attacking the roots of cotton.

Cooperation.—South Carolina Agricultural College.

Location.—Clemson College and Columbia, S. C.

Date begun.—1910.

Results.—Preliminary results have been published through the South Carolina Experiment Station. These results indicate relief through a rotation of crops.

Cotton Root Aphides—Continued.

Probable date of completion.—1916.

Assignment.—A. F. Conradi.

Proposed expenditures, 1915–16.—$450.

Cotton Red Spider:

Object.—To determine practical means of reducing losses to cotton planters caused by the red spider and to conduct practical demonstrations.

Procedure.—A very thorough study of the biology of the pest is being made, in order to ascertain the weak points in the insect's life history. Large practical experiments are being conducted to test all possible methods of control.

Cooperation.—South Carolina Experiment Station.

Location.—Batesburg, S. C.; general observations in other sections of the cotton belt.

Date begun.—1910.

Results.—A very complete report of the results to date has just been transmitted for publication. In this report various important methods of control are described.

Assignment.—E. A. McGregor, F. L. McDonough.

Proposed expenditures, 1915–16.—$4,300.

Cotton Insect Injury in the Imperial Valley, Cal.:

Object.—To determine the extent of injury by cotton thrips and other insects affecting cotton in the Imperial Valley and to perfect methods of control.

Procedure.—This project will involve trips of inspection, in which a very thorough study of the conditions will be made.

Cooperation.—Bureau of Plant Industry and the horticultural commissioners in Imperial County, Cal.

Location.—El Centro, Cal., and other points in the Imperial Valley.

Date begun.—1913.

Results.—A preliminary list of the insects attacking cotton in the Imperial Valley has been prepared.

Assignment.—W. D. Pierce.

Proposed expenditures, 1915–16.—$2,300.

Miscellaneous Insects Affecting Cotton:

Object.—To determine the extent to which insects that feed upon the blooms may be responsible for the well-known shedding of cotton fruit; to study the relation of cutworms, aphides, and other insects to the abortive condition of cotton plants; to determine means of reducing the damage to the squares by cotton fleas and other piercing bugs; to ascertain the relationship between insects and cotton diseases.

Procedure.—A very thorough investigation of the life history of all insects attacking cotton will be made at Thomasville, Ga. Most of these insects have not been studied critically and there are therefore no present known means of control. An effort will be made to find the proper and most expedient means of control for each species. Special attention will be given to the insects known as sharpshooters, cotton stainers, and boll-feeding bugs. The parasites of the insects will be studied very carefully.

Cooperation.—State entomologists of Georgia and other States in the cotton belt.

Location.—Thomasville, Ga.; Victoria, Tex.; Calexico and El Centro, Cal.; Tucson, Ariz.; Tallulah, La.; and Batesburg, S. C.

Date begun.—1913.

Results.—The principal results obtained under this project have been along the lines of reducing the damage from the cotton-leaf worm and southern grass worm by timely warnings of their approach. A large mass of unclassified notes has been gathered on the life histories of many cotton pests, and a complete bibliography of the cotton insects of the world has been prepared to assist in this work.

Assignment.—G. D. Smith, W. D. Pierce, J. D. Mitchell, B. R. Coad, E. A. McGregor.

Proposed expenditures, 1915–16.—$6,000.

Total, Cotton Insect Investigations, $27,900.

TOBACCO INSECT INVESTIGATIONS.

Tobacco Hornworms:

Object.—To test control measures to reduce losses, especially by the use of powdered arsenate of lead.

Procedure.—A sufficiently large force of temporary men will be employed so that experiments can be made on a number of plantations in Kentucky and Tennessee. If possible, this work will be extended to the tobacco plantations of Virginia and North Carolina. The object of these experiments will be to determine the exact methods of applying the poison.

Cooperation.—Tennessee Experiment Station.

Location.—Clarksville, Tenn., and points in Kentucky and Tennessee.

Date begun.—1912.

Results.—The practical value of arsenate of lead used in the powdered form has been determined and published. This investigation has resulted in finding a better form of arsenate of lead for such work than had previously been used, and it has been possible to suggest improvements in the apparatus for the application of the poison.

Assignment.—A. C. Morgan.

Proposed expenditures, 1915–16.—$9,000.

Cigarette Beetle:

Object.—To determine feasible means of preventing losses in warehouses and factories.

Procedure.—Experiments are under way to test the value of artificial heat and cold, fumigants, electricity, methods of storage, and cleanliness in warehouses, with a view to finding the best means of control.

Cooperation.—Tobacco warehouses and factories and manufacturers of different types of electrical apparatus.

Location.—Richmond, Va.; Tampa, Fla.; Clarksville, Tenn.

Date begun.—1910.

Results.—More data have been secured relating to the value of artificial cold in controlling the cigarette beetle. After several years of futile experiments with the X ray there are now some indications of successful sterilization of the eggs by this treatment. The inefficiency of various means of control has been determined.

Assignment.—G. A. Runner, A. C. Morgan.

Proposed expenditures, 1915–16.—$2,650.

Insect Transmission of Mosaic Disease:

Object.—To determine what insects are capable of transmitting the mosaic disease under different conditions and to devise means of controlling these insects and preventing the spread of the disease through them.

Procedure.—Careful caging of insects which have been placed in contact with the disease will be carried on and an attempt made to ascertain whether they can transmit the disease to known healthy plants.

Cooperation.—Bureau of Plant Industry and Tennessee Experiment Station.

Location.—Clarksville, Tenn.

Date begun.—1913.

Results.—It has been determined that the tobacco flea beetle and hornworms may, under certain conditions, be transmitters of the disease.

Assignment.—S. E. Crumb, A. C. Morgan.

Proposed expenditures, 1915–16.—$1,850.

Miscellaneous Tobacco Insects:

Object.—To determine the possibility of preventing serious losses from miscellaneous tobacco insects, including bud worms, wireworms, thrips, and the large tobacco beetle, by the use of poisons and other methods.

Procedure.—Careful biological studies will be made of all tobacco insects which are observed. Tests with possible methods of control will be conducted and general observations made on the effect of general farm practices on injury.

Cooperation.—Florida, Virginia, and Tennessee experiment stations.

Location.—Clarksville, Tenn.; Quincy, Fla.; Appomattox, Va.; and points in Kentucky.

Miscellaneous Tobacco Insects—Continued.
Date begun.—1910.
Results.—The control of the wireworm has been worked out and published. Considerable information has been obtained upon the budworm in Florida. A complete bibliography of tobacco insects has been prepared.
Assignment.—A. C. Morgan.
Proposed expenditures, 1915–16.—$3,500.

Total, Tobacco Insect Investigations, $17,000.

RICE INSECT INVESTIGATIONS.

Rice Water Weevil and Other Rice Insects:
Object.—To investigate the means of control of rice insect pests.
Procedure.—Trips of investigation are made to various rice-growing regions to determine insect injury and to ascertain the results of various types of farm practice.
Cooperation.—Louisiana Experiment Station.
Location.—Points in Louisiana, Arkansas, and Texas.
Date begun.—1912.
Results.—The control of the rice water weevil by manipulation of water has been worked out at Crowley, La. A large quantity of notes has been accumulated on the life histories of other rice insects. A complete bibliography of rice insects is maintained at the headquarters at Washington.
Assignment.—J. L. Webb.
Proposed expenditures, 1915–16.—$2,000.

SUGAR-CANE INSECT INVESTIGATIONS.

Sugar-Cane Moth Borer:
Object.—To discover means of controlling the moth borer in sugar cane and corn, especially in adapting cultural practices to the increase of its parasitic enemies.
Procedure.—Thorough experimental work is conducted in Louisiana with all possible methods of control. This work has been mainly along the lines of disposition of the trash and manner of planting the seed cane. One agent has been sent to Cuba to thoroughly investigate practices in vogue on that island and also to obtain parasites for introduction.
Cooperation.—Louisiana Experiment Station and Estacion Experimental Agronomica, Santiago de las Vegas, Cuba.
Location.—New Orleans, La.
Date begun.—1910.
Results.—Preliminary results have been obtained indicating the proper disposition of trash and better methods of planting.
Assignment.—T. E. Holloway, U. C. Loftin, E. R. Barber.
Proposed expenditures, 1915–16.—$2,400.

Miscellaneous Insects Affecting Sugar Cane:
Object.—To determine the damage done to sugar cane by miscellaneous insects, including mealy bugs and root borers, and to perfect means of control.
Procedure.—This project is conducted by field examinations, laboratory work, and explorations, as well as by practical field experiments.
Cooperation.—Louisiana Experiment Station and the Estacion Experimental Agronomica, Santiago de las Vegas, Cuba.
Location.—New Orleans, La.
Date begun.—1911.
Results.—Information has been obtained as to the means of control of several of these insects, and parasites have also been obtained for some of them.
Assignment.—T. E. Holloway, U. C. Loftin.
Proposed expenditures, 1915–16.—$1,700.

Total, Sugar-Cane Insect Investigations, $4,100.

ARGENTINE ANT INVESTIGATIONS.

Argentine Ant Investigations:

Object.—To reduce losses occurring in cane plantations and orchards and to prevent annoyance in houses, warehouses, and elsewhere due to the Argentine ant.

Procedure.—Large-scale practical control experiments have been conducted at various points in New Orleans and at Hattiesburg, Miss. At the latter place a special attempt has been made to exterminate the species by means of the distribution of poison baits. This project also includes a survey of the dispersion of the species.

Cooperation.—Louisiana Experiment Station and the city of Hattiesburg, Miss.

Date begun.—1910.

Results.—An improved poison bait has been devised, which is very effective in controlling this species. Its efficiency has been demonstrated especially at Hattiesburg, Miss., and in Audubon Park, New Orleans, where the ants have been greatly reduced.

Assignment.—E. R. Barber.

Proposed expenditures, 1915–16.—$3,500.

Total, Southern Field-Crop Insect Investigations, $62,000.

[Research.]

FOREST AND SHADE-TREE INSECT INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—To supervise the field and laboratory investigations and conduct the necessary administrative and office work incident thereto.

Location.—The office and laboratory work is conducted at Washington and the field work at special field stations representing defined sections or districts of the country. The location of field stations for 1916 are: Colorado Springs, Colo., for the southern Rocky Mountain region; Missoula, Mont., for the northern Rocky Mountain region; Placerville, Cal., for the Pacific slope; Ashland, Oreg., for the investigation of insects affecting the seeds of western conifers; and East Falls Church, Va., for the central and eastern United States.

Date begun.—1902.

Assignment.—A. D. Hopkins.

Proposed expenditures, 1915–16.—$5,200.

BIOLOGICAL AND ECONOMIC RESEARCH (FIELD INVESTIGATIONS).

Forest-Reproduction Insects:

Object.—To determine the character and cause of (*a*) injuries to the flowers, fruit, and seed on the trees and to the seeds stored or in the ground, and (*b*) injuries to the roots, stems, branches, and foliage of seedlings, saplings, and nursery stock; and to determine methods of prevention and control.

Procedure.—This is a general project, in which some attention is given to the subject by all members of the staff in connection with their regular field work. The data thus secured are submitted to the leaders for study, compilation, and publication.

Location.—United States.

Date begun.—1904.

Results.—The general information acquired on this subject renders it possible to give prompt and reliable information on specific questions. It has been found that certain wood borers attacking saplings of hardwood and coniferous trees cause an enormous loss in the form of defects in the wood of matured trees, deformed growth, etc., and that with further knowledge and practice a large percentage of the losses from this source can be prevented. (See also following special projects.) Publication issued: Department Bulletin 170, "The European Pine-Shoot Moth: A Serious Menace to Pine Timber in America."

Assignment.—A. D. Hopkins, Josef Brunner, J. M. Miller.

Proposed expenditures, 1915–16.—$2,500.

Insect Damage to Forest-Tree Seeds:

Object.—To determine the character and extent of damage by insects to the seeds of coniferous trees of the western United States and to carry on a systematic and economic study of the insects involved and of methods of control.

Procedure.—This is a special project, in which the leaders are assisted in the collection of material by other members of the field force in the area mentioned and by the laboratory force at Washington in the identification of species.

Location.—Ashland, Oreg. (field station). Field of operations, Pacific slope and Rocky Mountain regions.

Date begun.—1913.

Results.—It has been found that a very large percentage of the seed crop of western coniferous trees is destroyed by seed-infesting insects and that losses by collectors and planters through the handling of defective seed can be avoided through the utilization of available information. Data in Department Bulletin 95, "Insect Damage to the Cones and Seeds of Pacific Coast Conifers."

Probable date of completion.—1918.

Assignment.—J. M. Miller, P. D. Sergent, F. P. Keen, J. E. Patterson.

Proposed expenditures, 1915–16.—$2,500.

Damage to Reproduction Conifers by Lepidopterous Insects and Pissodes Beetles:

Object.—To determine the character and extent of damage to pine and other conifers by the tip moth, pitch worms, and other insects, and to conduct a systematic and economic study of the insects and methods of preventing losses.

Procedure.—Same as preceding project.

Location.—Missoula, Mont. (field station). Field of operations, Pacific slope and Rocky Mountain regions.

Date begun.—1913.

Results.—The damage to reproduction pine caused by small caterpillars mining in the tips of new growth, the bark of pine and Douglas fir saplings, and the base of trees is very serious in some localities, and evidence has been secured that much of this loss can be prevented by proper management of forest nurseries and plantation growth. Data in Department Bulletin 111, "The Sequoia Pitch Moth, a Menace to Pine in Western Montana." Manuscript has also been submitted for another bulletin.

Probable date of completion.—1918.

Assignment.—Josef Brunner, Albert Wagner, J. C. Evenden.

Proposed expenditures, 1915–16.—$2,000.

Relation of Climatic Conditions to Forest Insect Life:

Object.—To determine the influence of (*a*) wet and dry seasons and warm and cold winters, (*b*) windstorms, (*c*) injuries by lightning, (*d*) dry and wet soils and other physical conditions, and (*e*) altitude, latitude, and longitude on the habits and periodical pheuomena of insects.

Procedure.—This is a general project, in which some attention is given to the subject by all members of the staff in connection with their regular field work. The data obtained in this way are submitted to the leader for study, compilation, and publication.

Location.—United States.

Date begun.—1905.

Results.—It has been found that (*a*) droughts are not favorable or unfavorable to tree-killing insects, (*b*) excessively cold winters will kill some insects, (*c*) windstorms often favor insect depredations, (*d*) lightning contributes to the multiplication of destructive insects, and (*e*) altitude, latitude, and longitude are important factors to be considered in connection with control operations. The information acquired on these subjects is of special value in the recommendations of methods of control and prevention of insect depredations.

Probable date of completion.—1920.

Assignment.—A. D. Hopkins.

Proposed expenditures, 1915–16.—$1,000.

Relation of Latitude and Altitude to the Periodical Phenomena of Insects, Especially Forest Insects:

Object.—To determine, by means of phenological data on plants and animals, the normal rate of difference in the beginning and ending of periodical phenomena of insects due to differences in altitude, latitude, and longitude, local physical conditions, etc.

Procedure.—This is a special project, in which the leader is assisted in the collection of data by all members of the staff in connection with their regular field duties. Beginning with the first evidence of activity in the spring, observations are made on different species of insects and plants at definitely located phenological stations at different latitudes and altitudes, and the observations are recorded on specially prepared blanks, which are submitted to the leader for study, compilation, and publication.

Cooperation.—Informally with the Bureau of Plant Industry and Weather Bureau.

Location.—United States.

Date begun.—1897.

Results.—It has been determined that for animals and plants of the median latitude of the United States there is a general average rate of difference in the periodical events in their life, reproduction, and growth of about 4 days for each degree of latitude, 4 days for each 400 feet of altitude, and 4 days for each 5 degrees of longitude. Studies in the practical application of this law have shown it to be of great importance in planning and conducting control work against forest insects and that it has a broad application also in periodical farm and garden operations.

Assignment.—A. D. Hopkins.

Proposed expenditures, 1915–16.—$2,250.

Relation of Injuries by Lightning to Subsequent Injuries by Insects:

Object.—To determine the relation of injuries by lightning to (*a*) the direct cause of the death of trees, (*b*) subsequent attack by Dendroctonus beetles as a cause of death, (*c*) attack by other insects as the final cause of death, (*d*) the starting of destructive outbreaks of Dendroctonus beetles, (*e*) the starting of fires from old, dead, lightning-struck or insect-killed trees, and (*f*) the attraction of destructive insects to near-by healthy trees.

Procedure.—This is a special project, in which the leaders give special attention to the subjects outlined under "Object." The records of observations by all members of the field force are made available to them in working up the data for publication.

Location.—Colorado Springs, Colo. (field station). Field of operations, Pacific slope and Rocky Mountain regions.

Date begun.—1905.

Results.—It has been found that lightning rarely kills a tree unless it shatters it, but that the death of trees slightly injured by lightning is often caused by insects and that, in some cases, outbreaks of a destructive insect are thus started. A large amount of data has been collected, which is being prepared for publication.

Probable date of completion.—1916.

Assignment.—W. D. Edmonston, George Hofer.

Proposed expenditures, 1915–16.—$500.

Interrelation of Insects and Forest Fires in the Destruction of Forests:

Object.—To determine the relation of injuries by insects to subsequent injuries or destruction by forest fires and the relation of injuries by forest fires to subsequent injuries by insects.

Procedure.—This is a special project, in which the leaders are assisted in the collection of data by all members of the field force in the area mentioned. It includes studies of injuries by insects to the bark at the base of living trees and of their relation to subsequent fire wounds; the work of bark-boring insects in fire wounds and its relation to extension of injury by subsequent fires; the relation of small and large areas of insect-killed timber to favorable conditions for the starting and spread of forest fires; the extension of fire-wound injuries by wood-boring insects; the relation of fire-injured and fire-killed trees to subsequent injuries by wood-boring insects to the trunks of trees, to the multiplication of destructive bark beetles, and to the extension of depredations on ad-

Interrelation of Insects and Forest Fires in the Destruction of Forests—Con.
jacent uninjured trees by bark beetles and other insects breeding in fire-injured and fire-killed trees.

Location.—Missoula, Mont. (field station). Field of operations, Pacific slope and Rocky Mountain regions.

Date begun.—1899.

Results.—It has been determined that insects are the primary cause of the death of more merchantable-sized timber than is caused by forest fires, that the timber killed by insects contributes to the starting and spread of destructive fires, and that, therefore, the control of the destructive insects will contribute to the control of forest fires. A large amount of data has been collected, which is being prepared for publication.

Probable date of completion.—1916.

Assignment.—Josef Brunner, Albert Wagner, J. C. Evenden.

Proposed expenditures, 1915–16.—$1,000.

Insect Damage to the Wood of Fire-Killed Timber:

Object.—To determine the character and extent of damage by wood-boring insects to fire-killed timber and to prosecute a systematic and economic study of the insects involved.

Procedure.—This is a general project, in which some attention is given to the subject by all members of the staff in connection with their regular field work. The data thus collected are submitted to the leader for study, compilation, and publication.

Location.—United States.

Date begun.—1905.

Results.—It has been determined that very great losses are caused by this class of insects and that, through a proper application of the results of investigations already made, a large percentage of such losses can be prevented. A manuscript has been submitted for a bulletin giving the results of investigations.

Assignment.—A. D. Hopkins.

Proposed expenditures, 1915–16.—$500.

Insects Injurious to Forest Products:

Object.—To determine the character, cause, and extent of injuries to crude, finished, and utilized forest products and methods of preventing losses; the relative immunity of different species of wood to attack by termites; the relative efficiency of chemical preservatives in the treatment of cabinet and other woods against attack by termites and other wood-boring insects; the relative efficiency of chemical preservatives and methods against insect attack on wood set in the ground; the character and extent of the damage caused by termites and practical methods of prevention and control; powder-post injury to seasoned forest products; and damage to poles, posts, mine props, railroad ties, and similar forest products by wood-boring insects.

Procedure.—This is a general project, in which some attention is given to the subject by all members of the staff in connection with their regular field work. The data obtained are submitted to the leaders for study, compilation, and publication. It includes studies of the character and cause of injuries to recently felled trees, saw logs, round timber, rough timber, and other unseasoned crude products; injuries to seasoned rough and dressed lumber and finished wood material; injuries to construction timbers and other wood material used in buildings, bridges, railroad construction, mining, etc.; injury to stored oak and hemlock bark for tanning purposes; injuries to medicinal bark, roots, leaves, etc.; and experiments to determine methods of preventing losses.

Cooperation.—Informal cooperation with manufacturers and utilizers of forest products.

Location.—East Falls Church, Va. (field station). Field of operations, United States; Central and South America, through correspondence.

Date begun.—1902.

Results.—The results of extensive investigations and experiments with wood preservatives on different kinds of wood have shown that a large percentage of the serious losses heretofore suffered can be prevented, and the methods recommended are being put into practice. The Army and Navy have adopted the department's recommendations in regard to

Insects Injurious to Forest Products—Continued.

powder post for their storehouses, and leading manufacturers all over this country are profiting by the information disseminated. As a result of detailed study and experiments with poles set in the ground and in mines, railroad, telephone, telegraph, and mining industries are adopting and putting into practice the methods recommended, with most gratifying results. Publications issued: Bureau of Entomology Bulletin 58, Part V, "Insect Depredations in North American Forests and Practical Methods of Prevention and Control"; Bulletin 94, Part II, "Insects Injurious to Forests and Forest Products," "Biology of the Termites of the Eastern United States, with Preventive and Remedial Measures"; Circular 128, "Insect Injuries to Forest Products"; Circular 134, "Damage to Telephone and Telegraph Poles by Wood-Boring Insects"; Circular 156, "Insect Damage to Mine Props and Methods of Preventing the Injury"; Department Yearbook for 1904, "Insect Injuries to Forest Products." Another manuscript has been submitted for publication.

Assignment.—A. D. Hopkins, T. E. Snyder, F. C. Craighead.

Proposed expenditures, 1915–16.—$3,090.

Hickory Insects:

Object.—To make a thorough study of all insects found to affect the different species of hickory, to determine the cause of the extensive dying of hickory and of injury to its products, and to develop methods of controlling the primary enemies of the tree and of preventing losses of the crude and stored commercial products of wood and nuts.

Procedure.—This is a general project, in which the leaders are assisted in the collection of material by other members of the field force in the area mentioned and by the systematists at Washington in the identification of species. It includes the collection of material of all stages of the insects and their work, with full field notes on observations, experiments with trap trees, natural enemies, and other methods of control, and also systematic work on the classification and description of species.

Location.—Eastern United States.

Date begun.—1902.

Results.—The seasonal history of the hickory bark beetle has been completed, and as a result of information disseminated through publications and correspondence this most destructive enemy of the hickory trees of the eastern United States is being brought under control.

Probable date of completion.—1918.

Assignment.—A. D. Hopkins, W. S. Fisher, T. E. Snyder, F. C. Craighead.

Proposed expenditures, 1915–16.—$3,000.

Ash Insects:

Object.—To make a thorough study of the insects of different species of ash, determine the cause of injuries to the tree and its products, and develop methods of controlling the primary enemies and of preventing losses of the crude and stored commercial products.

Procedure.—Same as preceding project.

Location.—United States.

Date begun.—1904.

Results.—It has been determined that the damage to ash trees and their crude and finished products caused by wood-boring insects is very extensive and that much of this loss can be prevented.

Probable date of completion.—1920.

Assignment.—A. D. Hopkins, T. E. Snyder, F. C. Craighead.

Proposed expenditures, 1915–16.—$1,200.

Economic Investigation of the Scolytid Bark and Timber Beetles of North America:

Object.—To determine the character and extent of damage caused by these insects to forest growth and forest products, the seasonal histories and habits of the principal species, and practical methods of preventing losses from their attacks.

Procedure.—This is a general project, in which the leader is assisted by other members of the field force in connection with their regular field duties, and includes the collection of material of all stages of the insects and their work, with full field notes on observations relating to seasonal histories, habits, and methods of control, experiments with natural enemies, and verification of results. These data are submitted to the leader for study, compilation, and publication.

Economic Investigation of the Scolytid Bark and Timber Beetles of North America—Continued.

Cooperation.—Department of the Interior, in the investigation and verification of results of practical control work against the Dendroctonus beetles in the national parks.

Location.—United States.

Date begun.—1890.

Results.—The results of investigations of methods of controlling depredations by bark beetles in the coniferous forests of North America have made it possible to discover and recommend practical methods of protecting national, State, and private forests from their most destructive insect enemies. This alone results in a saving of not less than $10,000,000 annually in the value of timber protected at little or no first cost. One of the principal results is the discovery by the leader of a percentage principle of control by which, through the disposal of 25 to 75 per cent of the infestation by Dendroctonus beetles, they are brought under complete control. This principle has been successfully established in more than 20 demonstration projects, involving hundreds of thousands of acres of infested forests. Many publications have been issued giving results of the investigations.

Assignment.—A. D. Hopkins.

Proposed expenditures, 1915–16.—$3,700.

Economic Study of Forest Buprestidæ, or Flat-Headed Borers:

Object.—Same as preceding project.

Procedure.—Same as preceding project. This is a special project.

Location.—Placerville, Cal. (field station). Field of operations, United States.

Date begun.—1904.

Results.—It has been determined that some of the flat-headed borers are destructive to living timber, while others are destructive to the wood of living and dead timber, and that a large percentage of the losses can be prevented through a practical application of the information already acquired and published. A manuscript is being prepared for publication, giving some results of the past year's work.

Assignment.—H. E. Burke.

Proposed expenditures, 1915–16.—$1,000.

Economic Study of Forest Cerambycidæ, or Round-Headed Borers:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Location—East Falls Church, Va. (field station). Field of operations, United States.

Date begun.—1904.

Results.—The results of a special study of this class of bark and wood borers have shown that they are far more destructive than was heretofore supposed. Special progress has been made in seasonal history studies, which suggest practical methods of preventing losses. A publication is in press giving some of the results of the past year's work.

Assignment.—F. C. Craighead.

Proposed expenditures, 1915–16.—$2,000.

Economic Study of Beneficial Forest Insects:

Object.—To determine the character and extent of beneficial influences of parasitic and predatory insects, their seasonal histories and natural enemies, methods of propagating and encouraging their beneficial work, importation of foreign species, and artificial dissemination of native species.

Procedure.—Same as preceding project. This is a general project.

Location.—East Falls Church, Va. (field station). Field of operations, United States.

Date begun.—1903.

Results.—Many new facts have been determined regarding the principal parasitic and predaceous insects which are the natural enemies of injurious insects, and this information has been of special importance in connection with the practical application of artificial methods of control.

Assignment.—A. D. Hopkins, A. B. Champlain, S. A. Rohwer, Adam Boving.

Proposed expenditures, 1915–16.—$1,870.

Systematic and Economic Investigations of the Bark Lice of the Genus Chermes:

Object.—The determination of systematic and bionomic facts relating to the species of Chermes which infest the bark of coniferous and other forest trees, with special reference to the one or more species at present recognized as *Chermes pinicorticis* Fitch, and to determine the character and extent of injury resulting from its presence on the living bark of young to matured white pine (*Pinus strobus*).

Procedure.—Same as preceding project.

Location.—United States.

Date begun.—1908.

Results.—It has been found that this class of insects, each species of which lives alternately on two different species of trees, making galls on the twigs of spruce and infesting the twigs and bark of pine, is of special economic importance. It has been discovered that if nursery and ornamental trees are sprayed with kerosene emulsion at the time new growth starts on the twigs it will protect the trees from damage by this class of insects.

Assignment—A. D. Hopkins.

Proposed expenditures, 1915–16.—$500.

Agrilus Beetles:

Object.—To investigate the relation of Agrilus beetles to (*a*) the direct death of trees, (*b*) trees injured by disease, (*c*) trees defoliated by insects, (*d*) trees the roots of which have been injured by insects or other agencies, (*e*) trees struck by lightning or injured from other causes, and (*f*) stumps of trees felled during the winter; to determine the seasonal histories and habits of the beetles, general and local; to determine the natural enemies of different stages of Agrilus beetles and the relation of such enemies to natural control; to conduct investigations and experiments looking to a determination of practical methods of control and prevention of depredations by the various species of Agrilus on forest-tree growth.

Procedure.—Same as preceding project.

Location.—East Falls Church, Va., and Placerville, Cal. (field stations). Field of operations, United States.

Date begun.—1913.

Results.—It has been found that many of these beetles are very destructive to many kinds of trees and as secondary enemies to trees weakened by other insects or disease are often more important than the primary enemy and as a rule may be more readily controlled. The seasonal histories of some of the more important species have been worked out and important new facts determined in regard to their habits. Many new undescribed species of the insect enemies of the beetles have been discovered and their habits studied. With a knowledge of these natural enemies, artificial measures can be employed in such a manner as to get the best results with the least cost.

Probable date of completion.—1920.

Assignment.—A. D. Hopkins, H. E. Burke, T. E. Snyder, F. C. Craighead, W. S. Fisher, S. A. Rohwer.

Proposed expenditures, 1915–16.—$2,000.

Relation of Mistletoe on Living Trees to Attack by Insects:

Object.—To determine (*a*) whether trees infested by mistletoe are more subject to attack by bark-boring insects than trees not so affected; (*b*) whether trees weakened by mistletoe contribute to the increase of tree-killing insects; and (*c*) the relation of the subject to the general problem of insect control.

Procedure.—Same as preceding project. This is a special project.

Location.—Placerville, Cal. (field station). Field of operations, Pacific slope and Rocky Mountain regions.

Date begun.—1913.

Results.—Heretofore it has been thought that trees infested by mistletoe were more subject to attack by tree-killing insects than trees not so infested. Investigations so far indicate that this is not the case.

Probable date of completion.—1916.

Assignment.—H. E. Burke.

Proposed expenditures, 1915–16.—$250.

Insect-Control Instructions and Demonstrations in the National Parks:

Object.—To give instructions on the essential practical details and to conduct demonstration projects on the control of Dendroctonus beetles in national partks and other Federal reservations, in accordance with principles and methods recommended by the Department of Agriculture.

Procedure.—This is a special demonstration and instruction project, in which the Department of the Interior details park rangers to the Bureau of Entomology to receive instructions from an entomological ranger of the Department of Agriculture, who has been trained as an expert on the practical details of cruising and locating infested timber and in the application of the measures advised by the leader of this project. The instructions relate specifically to (*a*) methods of cruising to locate the infested timber requiring treatment, (*b*) the essential practical details of conducting the work of control and protection against Dendroctonus beetles, (*c*) the inspection of areas in which control work has been done, (*d*) the location of areas requiring treatment, (*c*) estimating the character and extent of insect-killed or infested timber, and (*f*) such other matters pertaining to the practice of forest entomology as may be deemed necessary. All entomological matters except the minor questions that can be handled by the insect-control expert will be referred by him either to a local entomological expert of the Branch of Forest Insects, Bureau of Entomology, or to the chief of the branch at Washington for advice or recommendations. The Bureau of Entomology pays the salary of the entomological ranger; the Department of the Interior pays his traveling and field expenses and also the salaries and expenses of the park rangers assigned to the work and the expenses of all cruising and control operations. When the park rangers are sufficiently trained and qualified they are to be designated as insect-control rangers and assigned to a national park to work under the immediate supervision of the park supervisor or superintendent.

Cooperation.—Department of the Interior.

Location.—Washington, D. C., and Yosemite National Park for 1915–16.

Date begun.—1913.

Results.—The work done in 1913 and 1914 has yielded most gratifying results in verifying and demonstrating the practicability and efficiency of the percentage principle of control. The Yosemite Valley is now practically free from damage, and the depredations on the Hetch Hetchy watershed, where a vast amount of timber has been killed during the past 10 or more years, is now under control.

Probable date of completion.—1920.

Assignment.—A. D. Hopkins, supervision; J. J. Sullivan, entomological ranger in charge of demonstrations and instructions in national parks; Chas. F. Adair and Chas. C. Bull, park rangers assigned to receive instructions.

Proposed expenditures, 1915–16.—$500.

Investigation of Insects Affecting Shade Trees and Hardy Shrubs:

Object.—To determine (*a*) the general character and extent of damage by insects to the trees and shrubs of public and private grounds, including municipal parks, streets, and cemeteries, country roads, private parks, national cemeteries, etc., (*b*) additional facts on the seasonal histories and habits of the insects involved, and (*c*) additional facts on practical methods of prevention and control; to conduct experiments and finally to give advice through correspondence, publications, and otherwise on the principles and methods of control to meet the requirements of specific insects and local conditions.

Procedure.—This is a general project, to which all of the time of an assistant leader will be devoted to supervision and investigations, and all members of the regular field and laboratory force will devote more or less time to the collection of material and the study and identification of insects.

Cooperation.—Some informal cooperation will be invited with municipalities, Federal and State officials, and owners of private parks and grounds looking to their adoption of the most economical and effective methods of prevention and control, the conduct of experiments with new methods, and the verification of results in practice.

Location.—Washington, D. C.

Investigation of Insects Affecting Shade Trees and Hardy Shrubs—Cont'd.

Date begun.—July 1, 1915.

Results.—Recent observations and inquiries indicate that the amount of money expended by municipalities and wealthy owners of private grounds and parks each year on useless or improperly applied methods of combating insects affecting shade trees and ornamental shrubs represents a greater loss than that caused directly by the insects. Observations and experience also indicate that, if the proper methods of prevention and control are adopted and carried out in accordance with advice from the most reliable sources, the waste of money and the damage and annoyance from the insects will be reduced to a minimum.

Assignment.—A. D. Hopkins.

Proposed expenditures, 1915–16.—$6,000.

Total, Biological and Economic Research (Field Investigations), $37,360.

SYSTEMATIC RESEARCH (LABORATORY INVESTIGATIONS).

Forest and Other Scolytidæ:

Object.—To (*a*) determine, classify, and describe the genera, species, and stages of development which are new to science; (*b*) revise and bring up to date the systematic knowledge of all North American species; (*c*) investigate problems relating to anatomy, taxonomy, terminology, and nomenclature; (*d*) determine seasonal histories, food and breeding habits, geographical distribution, and such other information of a technical nature about the species as is essential to the best success in the investigation and practical treatment of economic problems.

Procedure.—This is a special project, in which specimens of all stages of the insects and their work are collected by the leader and members of the force in connection with their regular field duties from all parts of the United States or are received by exchange or for identification from all parts of the world. These specimens are labeled, classified, and preserved in a separate collection in the National Museum with the collection of forest insects under the custodianship of the leader. Such time as can be spared from the regular administrative duties is devoted to a systematic study of the material and the literature on the subject and to the preparation of manuscripts for permanent record and publication.

Location.—Washington, D. C.

Date begun.—1902.

Results.—The results of the systematic work on this group of insects have shown that previous to the leader's work on this group nothing whatever had been known of a large number of the most destructive insect enemies of North American forest trees. The information acquired has made it possible to study their exact economic relations to the trees and to discover practical methods of control and prevention. The value of the result of this work alone may be estimated in tens of millions of dollars toward the practical conservation of the forest resources of the United States. The collections are the largest in the world, and specimens are sent here from many other countries for authentic identification. Three publications have been issued within the past year giving some results of the work: Proceedings of the United States National Museum, vol. 48, pp. 115-136, "List of Generic Names and Their Type Species in the Coleopterous Superfamily Scolytoidea"; Bureau of Entomology Bulletin 17, Part II, "Contributions Toward a Monograph of the Scolytid Beetles," "Preliminary Classification of the Superfamily Scolytoidea"; and Report No. 99, Office of the Secretary, "Classification of the Cryphalinæ, with Descriptions of New Genera and Species."

Assignment.—A. D. Hopkins.

Proposed expenditures, 1915–16.—$1,500.

Forest and Other Buprestid Larvæ:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Location.—Placerville, Cal. (field station). Field of operations, United States.

Date begun.—1904.

Forest and Other Buprestid Larvæ—Continued.

Results.—Heretofore practically nothing was known of the systematic characters by which the larvæ of various species of this class of insects could be identified, and without this knowledge very little could be accomplished in the study of seasonal histories and habits, and practically nothing could be done toward the discovery of effective methods of control. Special progress has been made in this work in the discovery of new facts of economic importance. A manuscript is in preparation giving some of the results of the work of the preceding year.

Assignment.—H. E. Burke.

Proposed expenditures, 1915–16.—$1,500.

Forest and Other Cerambycid Larvæ:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Location.—Washington, D. C. Field of operations, United States.

Date begun.—1904.

Results.—Exceptional progress has been made in the investigation of these larvæ. While they are of great economic importance, very little was known about them a few years ago. Now more than 250 species have been identified and a fund of information acquired of great scientific and economic value. A publication is in press giving some of the results of the work during the past few years.

Assignment.—F. C. Craighead.

Proposed expenditures, 1915–16.—$1,500.

Forest Hymenoptera:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Location.—Washington, D. C. Field of operations, United States.

Date begun.—1909.

Results.—The results of systematic work on this group of insects, which includes both injurious and beneficial species, are of special scientific and economic importance. Without the knowledge gained from such a study it would be impossible to arrive at definite conclusions as to the relation of the beneficial insects to natural control or to profit by their beneficial influences in connection with the practice of artificial methods of combating insects. Many publications have been issued during the past year in the Proceedings of the United States National Museum, etc.

Assignment.—S. A. Rohwer, William Middleton.

Proposed expenditures, 1915–16.—$2,000.

Forest Lepidoptera:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Location.—Washington, D. C. Field of operations, United States.

Date begun.—1912.

Results.—Until recent years this important group of forest insects had been almost neglected in this country, but now that a specialist is working on it rapid progress is being made and information acquired which is of fundamental importance to the field investigations of economic problems. Large additions have been made to the collection.

Assignment.—Carl Heinrich, J. J. De Gryse.

Proposed expenditures, 1915–16.—$1,500.

Forest Coleoptera:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Location.—Washington, D. C.

Date begun.—1912.

Results.—This group of insects is represented by more species of economic importance than any other, and therefore requires special study and the proper arrangement and care of the collections, in which gratifying progress has been made.

Assignment.—W. S. Fisher.

Proposed expenditures, 1915–16.—$2,270.

Forest Diptera:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Location.—Washington, D. C.

Date begun.—1912.

Results.—Very little has been known of this group of insects in their relation to forest growth in America; hence the necessity of systematic work as a basis for economic investigations. Some important discoveries have been made during the past two years and large additions have been made to the collection.

Assignment.—C. T. Greene.

Proposed expenditures, 1915–16.—$2,000.

Forest and Other Isoptera:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Location.—Washington, D. C. Field of operations, United States.

Date begun.—1912.

Results.—The results of work on the white ants of North America have shown that they are of special economic importance, causing, as they do, great damage to buildings, poles, posts, construction timber, etc. It has been found that there is special need for detailed systematic study of the species as a basis for effective economic work. Publications issued: Bureau of Entomology Bulletin 94, part 2, "Insects Injurious to Forests and Forest Products," "Biology of the Termites of the Eastern United States, with Preventive and Remedial Measures." Another manuscript has been submitted for publication.

Assignment.—T. E. Snyder.

Proposed expenditures, 1915–16.—$1,500.

Forest and Other Coleopterous Larvæ:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Location.—Washington, D. C.

Date begun.—1913.

Results.—Practically nothing has been known of the immature stages of even the common beetles which infest the forest trees of this country and their products. The results so far attained show the absolute necessity of this work as a basis for economic investigations. Most gratifying progress has been made during the past year and several important papers have been published.

Assignment.—Adam Boving.

Proposed expenditures, 1915–16.—$2,500.

Total, Systematic Research (Laboratory Investigations), $16,270.

Total, Forest and Shade-Tree Insect Investigations, $58,830.

[Research.]

TRUCK-CROP AND STORED-PRODUCT INSECT INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—To supervise the research projects and carry on routine office, laboratory, and field work incidental thereto.

Location.—Washington, D. C.

Date begun.—1905.

Assignment.—F. H. Chittenden.

Proposed expenditures, 1915–16.—$6,620.

INVESTIGATION OF TRUCK-CROP INSECTS.

Potato Insect Investigations:

(*a*) Potato Tuber Moth—

Object.—To complete investigations of control measures against the potato tuber moth, investigate its continued spread to new localities, and transmit to quarantine officials available information in regard to this pest in order that an effective quarantine may be established.

Potato Insect Investigations—Continued.

(*a*) POTATO TUBER MOTH—Continued.

Procedure.—Through investigation and correspondence the spread of the insect is checked up. Field stations have been established in California, at which the life history of this insect under varying conditions is studied and practical tests on commercial quantities of potatoes are being made with reference to its eradication in interstate shipments of infested tubers. A series of field tests in cultural methods of control is being conducted, which, it is believed, will demonstrate the practicability of methods devised by the bureau for limiting the injury to potatoes in California. A study is also being made of natural enemies, in cooperation with the California State Horticultural Commission.

Location.—Pasadena and other points in California.

Date begun.—1912.

Results.—The life history has been worked up and a preliminary publication issued covering the methods of control, which has been republished as a Farmers' Bulletin. A number of useful parasites have been reared, and they will help materially in reducing this pest in time. Quarantine against infested districts in California has been established and the availability of practical control measures demonstrated.

Probable date of completion.—1917.

Assignment.—J. E. Graf.

Proposed expenditures, 1915–16.—$3,000.

(*b*) COLORADO POTATO BEETLE AND GENERAL POTATO INSECT PESTS—

Object.—The completion of work now in progress for the control of the Colorado potato beetle, the potato eelworm, the potato flea beetle, the potato leaf hopper, the potato stalk weevil, white grubs, wireworms, and other general potato pests. Further information concerning the life history of the potato beetle in the South is desired, and, since injury to potatoes has been reported in Michigan through the potato leaf hopper and in California through the potato eelworm, complete life histories of these comparatively new pests will be obtained and studies made of all conditions bearing on their potential injury to potatoes.

Procedure.—The life histories of the pests classified above are being investigated at field stations located favorably with regard to commercial potato plantings in infested districts, where on a practical scale experiments in the control of these pests may be made with both new and standard preparations in comparison. Since the Colorado potato beetle is extending its range westward, an investigation of its life history in the Pacific region of the United States will also be undertaken. White grubs and wireworms will be reared to maturity and their vunerable points especially noted by experiment. Tests of special spray materials and insecticide machinery devised for the more thorough application of insecticides are being conducted.

Cooperation.—Virginia Truck Experiment Station, Louisiana State Experiment Station, and the California Horticultural Commission.

Location.—Ventura County, Cal.; Baton Rouge, La.; Michigan; and southwestern Virginia.

Date begun.—1907.

Results.—The control of the Colorado potato beetle has been accomplished and a series of experiments against the potato flea beetle in Long Island completed, the results of which work will soon be available for publication. The potato eelworm has been the subject of investigation, but as yet the results are not sufficiently complete for publication. Tests of a power-driven potato sprayer have demonstrated the value of applications of insecticide material at high pressure. Life-history studies of the Colorado potato beetle have been completed with reference to the District of Columbia, and the results are now available for publication. Life histories of many other pests injurious to the potato have been recorded.

Assignment.—T. H. Jones, F. A. Johnston, D. E. Fink.

Proposed expenditures, 1915–16.—$2,500.

Onion Insect Investigations:

Object.—To obtain information regarding the various species of thrips which may attack the onion, and to study their methods of hibernation, alternate food plants, natural enemies, and life histories in their occurrence on onion and other cultivated plants, with a view to the adaptation

Onion Insect Investigations—Continued.

of methods of control by cultivation and insecticide application suitable to local conditions.

Procedure.—The life histories of onion thrips and related species are being studied in the field and in field laboratories situated with a view to the differences in local conditions which bear on the number of generations produced annually, wild host plants, methods of hibernation, control through climatic agencies and natural enemies, and the resistance of the plant attacked. Special spray materials and insecticide machinery devised to meet local conditions are being tested.

Cooperation.—South Texas Onion Growers' Association and growers.

Location.—Southern Texas and Stark County, Ind.

Date begun.—1907.

Results.—The life histories of the onion thrips have been worked out in both regions, and manuscripts are available for publication. All feasible preparations and special machinery for applying same have been tested, both to prevent and control losses. A preliminary publication on onion thrips and other onion insects has been issued.

Probable date of completion.—1917.

Assignment.—M. M. High.

Proposed expenditures, 1915–16.—$3,500.

Crucifer Insect Investigations:

Object.—To continue investigations projected during previous years for the determination of control measures available against the cabbage looper, southern cabbage webworm, and various aphides and thrips in their attacks on cruciferous crops, such as cabbage, cauliflower, and turnip, and to complete studies now being made of the life histories and habits of these and other pests, including the harlequin cabbage bug, root maggots, ants, and cutworms, with reference to their control by natural, cultural, or insecticidal means.

Procedure.—Field laboratories are established in extensive cole-crop districts, where studies of the life histories and control of the more serious pests encountered are continued. The value of trap crops against the harlequin cabbage bug in Texas and other portions of the South has been tested and demonstrated in a series of experiments. Practical control of cabbage aphides through the introduction of California ladybirds is being accomplished with thus far great success. The life history of the western cabbage root maggot has been undertaken in a new locality in the State of Washington and in California, where control by repellents and cultivation is meeting with success. In Wisconsin the eastern cabbage root maggot is also under observation and is the subject of experimental control measures.

Cooperation.—Virginia Truck Experiment Station and Wisconsin Experiment Station.

Location.—Norfolk, Va.; Brownsville, Tex.; Sacramento, Cal.; Washington State; and Green Bay, Wis.

Date begun.—1907.

Results.—The work begun in 1912 on the cabbage looper on Long Island was completed in 1914, and manuscripts embodying the features discovered there will soon be published. Field operations against the root maggots attacking cauliflower and cabbage on the Pacific coast and rendering the growing of radishes and turnips almost impossible have been successful in controlling the pest to a marked degree on experimental plats. An introduction of beneficial ladybirds from California has been instrumental in the almost complete control of the cabbage aphis in localities in Virginia where the introductions were made. The rule of cabbage as an alternate host plant for onion thrips has also been definitely ascertained, and the results are being adopted in southern Texas.

Probable date of completion.—1918.

Assignment.—D. E. Fink, M. M. High, R. E. Campbell, N. F. Howard, Arthur King.

Proposed expenditures, 1915–16.—$2,000.

Investigation of Pea Aphis:

Object.—To obtain further information regarding the pea aphis, its alternate host plants, number of generations, and especially its control in large commercial plantings of peas adjacent to canneries.

Investigation of Pea Aphis—Continued.

Procedure.—Field laboratories have been established in Michigan and in southern Virginia, where large commercial plantings of peas for canning are available for experiment. These are equipped with powerful high-pressure spraying outfits, and, since the life history of the pest is largely already a matter of record, the principal object of the investigation is to determine satisfactory control measures with standard and new insecticides.

Cooperation.—Virginia Truck Experiment Station and Hart Cannery, Hart, Mich.

Location.—Norfolk, Va., and Hart, Mich.

Date begun.—1907.

Results.—The life history of the pea aphis has been worked out in its occurrence in Maryland and adjacent States, its natural enemies observed, and results published. Much, however, remains to be done in regard to the control of this aphis on large plantings of commercial peas, especially where sown broadcast. The establishment of a new station at Hart, Mich., will undoubtedly further these investigations greatly during the coming season. The control of the pea aphis in small plantings and home gardens has been already successfully accomplished.

Probable date of completion.—1918.

Assignment.—F. A. Johnston, D. E. Fink.

Proposed expenditures, 1915–16.—$2,500.

Cucurbit Insect Investigations:

(*a*) MELON APHIS AND RELATED FORMS—

Object.—To devise a cheap and effective method of controlling the melon aphis on large commercial plantings of cucumber and cantaloupe.

Procedure.—Since the life history of the melon aphis has been previously the subject of publication, present experiments are intended to deal chiefly with control measures applicable to large irrigated fields in the Southwest. Applications of new and standard insecticides are being made with high-pressure engine-driven machinery, with a view to procuring thorough distribution of contact insecticides over infested plants.

Cooperation.—Virginia Truck Experiment Station.

Location.—Brownsville, Tex., and Norfolk, Va.

Date begun.—1908.

Results.—A cheap and effective control of the melon aphis has been obtained on small plants. Special machinery has been devised for the practical application of insecticides at extreme high pressures, so that colonies previously protected by the leaves may be treated. A publication covering the more important details of a biological nature and the remedies most readily applicable has been issued.

Assignment.—M. M. High, D. E. Fink.

Proposed expenditures, 1915–16.—Cost included under subproject *c*.

(*b*) PICKLE AND MELON WORMS—

Object.—To obtain information regarding the life histories and means of control of the pickle worm, melon caterpillar, and related species with somewhat different habits which injure with only slight infestation entire crops in the South.

Procedure.—The usual methods adopted for the investigation of injurious insect pests are practiced. Included in life-history studies are the effect of climatic conditions and natural enemies on the multiplication of these insects, which are more or less irregular and local in the attacks northward. Control experiments include the planting of trap crops and the testing of spraying methods.

Cooperation.—Virginia Truck Experiment Station and Louisiana Experiment Station.

Location.—Tidewater, Va.; Baton Rouge, La.; and Washington, D. C., and neighboring regions in Virginia and Maryland.

Results.—This project was begun on a small scale in 1909 in southern Florida, but on account of lack of funds it was found necessary to abandon this location. Local work has been accomplished in Virginia and Maryland. The project is practically being reestablished as a primary one because the insects frequently destroy 75 to 95 per cent of all melons in commercial fields. Manuscripts are being prepared for publication.

Cucurbit Insect Investigations—Continued.

(*b*) PICKLE AND MELON WORMS—Continued.

Assignment.—D. E. Fink, W. H. White.

Proposed expenditures, 1915–16.—Cost included under subproject *c*.

(*c*) GENERAL CUCURBIT INSECTS—

Object.—To conduct further investigation of the life histories of the pickle and melon worms, squash-vine borer, and the various cucumber beetles, and to further test remedies against these pests which have proved successful in small plats.

Procedure.—The usual methods of scientific investigation regarding life histories, habits, and economic treatment are followed. Experimental control having been demonstrated on small plats, larger areas will be covered in the effort to apply valuable information to practical results.

Location.—Norfolk, Va., and southern Texas.

Date begun.—1907.

Results.—A publication has been issued on the squash-vine borer, and treatment by covering the fruits has been successful in protecting cantaloupes against the ravages of the pickle worm over an area of 15 acres. Publications have likewise been issued on several of the more important cucumber beetles, and tests leading to the completion of investigations on minor pests of curbitaceous plants have been carried out.

Assignment.—M. M. High, D. E. Fink, W. H. White.

Proposed expenditures, 1915–16.—$2,500.

Sugar-Beet Insect Investigations:

(*a*) SUGAR-BEET LEAFHOPPERS—

Object.—The object of this project is to obtain exact information regarding the life histories, alternate food plants, and means for the control of leafhoppers injurious to beets, including the very destructive curly-top leafhopper, a pest which in some seasons totally destroys the sugar-beet crop in restricted localities and which is distributed over the entire Great Plains region and the Pacific coast.

Procedure.—A comprehensive study is being made of the life history of the pest in its attacks on other plants and alternate wild host plants, of the effect of the attack on sugar beets, and of the best means for its control. The treatment of large acreages of sugar beets by means of a spray has been found ineffective, and a study of the wild host plants is necessary in order to promote control by clean culture. The effect on the plant is being studied both under laboratory and field conditions and through the silage of beets attacked the previous year, in order to ascertain the toxic effect of the leafhopper puncture on the flowering organism. A determination of the exact factors which have caused the regular outbreaks of this pest in widely separated localities through the Rocky Mountain region is being made in localities where the leafhopper is regularly present through the abundance of its natural food plants.

Cooperation.—Beet-sugar factories where stations are located.

Location.—Pasadena, Oxnard, Spreckels, and Hayward, Cal.; Rocky Ford, Colo.

Date begun.—1909.

Results.—The sugar-beet leafhopper, which annually destroys from 50 to 90 per cent of the beet crop in widely separated localities, has been studied in Utah and Idaho and a preliminary report published. Preliminary work is also being undertaken in California and Colorado.

Probable date of completion.—1918.

Assignment.—C. F. Stahl, J. E. Graf, H. O. Marsh, B. L. Boyden.

Proposed expenditures, 1915–16.—$2,000.

(*b*) GENERAL SUGAR-BEET INSECTS—

Object.—To continue experiments in the control of the sugar-beet wireworm; to conduct tests on the control of leaf beetles, nematodes, webworms, white grubs, leaf miners, grasshoppers, and other insect enemies of sugar beets.

Procedure.—The usual methods of investigating the life histories and control of the pests above mentioned are followed. The hibernation of many sugar-beet pests offers a vulnerable point of attack and has been the constant subject of experiment in the Rocky Mountain and Pacific regions, especially with regard to clean cultural methods and the removal from in-

Sugar-Beet Insect Investigations—Continued.

(*b*) GENERAL SUGAR-BEET INSECTS—Continued.

fested fields of refuse sugar beets in the case of the wireworms. Control by insecticides is also established. Life histories of many of these pests have been worked out and observations continued on others in order to complete the project as soon as possible.

Cooperation.—State stations in California.

Location.—Pasadena, Spreckels, Hayward, and Oxnard, Cal.; Rocky Ford, Colo.

Date begun.—1908.

Results.—The sugar-beet webworm has been effectively controlled by the application of arsenical sprays. The beet-leaf beetle may be effectively destroyed during the winter by burning the large bunches of panic grass which grow in waste places about beet fields and under which they hibernate. Control measures for the beet wireworms have been developed and demonstrated, as published in a department bulletin, and results are now soon expected from work on the beet-root aphis. A report on the principal beet-feeding grasshoppers has been completed and is available for immediate publication. The life histories of many minor beet pests have also been investigated.

Assignment.—J. E. Graf, H. O. Marsh, B. L. Boyden, R. E. Campbell.

Proposed expenditures, 1915–16.—$4,500.

General Vegetable, Truck, and Garden Insect Investigations:

Object.—To control the insect enemies of such vegetables and truck crops as beans, tomato, cucumber, lettuce, celery, parsnips, parsley, salsify, pepper, rhubarb, okra, medicinal plants, condiments, and garden plants, including ornamentals, both in the field and in greenhouses and cold frames; and to conduct a similar study of mushrooms, to complete studies already begun in this line.

Procedure.—The methods adopted for the investigation of other injurious pests, including the completion of life-history work begun and studies of the effect of temperatures and of fumigants and other insecticides.

Cooperation.—Virginia Truck Experiment Station.

Location.—Washington, D. C., and Norfolk, Va.

Date begun.—1907.

Results.—Practical work on such insects as thrips, red spider, rose slugs, aphides or plant lice of some forms, white fly, leaf tiers and leaf rollers, rose beetles, cyclamen mite, and bulb maggots has been accomplished, and the results of many of these investigations have been published and are available. This work is facilitated by a new greenhouse and laboratory constructed for the purpose. A preliminary study has been made of mushroom insects, and a publication of results is available. Investigations have been completed on such insects as the rose slug caterpillar, Florida fern caterpillar, Abutilon moth, the spotted beet webworm, asparagus beetles, the asparagus miner, canna leaf roller, and greenhouse thrips.

Assignment.—C. H. Popenoe, W. H. White, D. E. Fink, F. H. Chittenden.

Proposed expenditures, 1915–16.—$7,500.

Total, Investigation of Truck-Crop Insects, $30,000.

INVESTIGATIONS OF STORED-PRODUCTS INSECTS.

General Stored-Product Insect Pests:

Object.—To continue and complete studies which have already been made on the principal insects injurious to general stored products. About 60 species are concerned in this investigation, principal among which are the rice and granary weevils, the Angoumois grain moth, Mediterranean flour moth, Indian meal moth, flour and grain beetles, the ham fly and ham beetles, various species of skin and carpet beetles, and many others, most of which are cosmopolitan. The lines of study may be grouped as follows: (1) Insects injurious to all forms of stored grain, including manufactured cereals, such as flour, meal, and breakfast foods. These will be studied with regard to their injury to grain stored in large and small bulk and in the package form where packed in this manner for convenience of consumers of cereals, as also in factories devoted to the

General Stored-Product Insect Pests—Continued.

manufacture or storage of such grains. (2) Insects injuring stored peas, beans, cowpeas, and other leguminous foods. Especial attention is given to the cowpea and broad bean weevils and to the bean and pea weevils in the Northern States. (3) Insects injurious to dried fruits and nuts. (4) Insects injurious to herbs, drugs, dried meats, hides, and leather and woolen and other manufactured fabrics and insects injurious in seed warehouses.

Procedure.—These insects are being studied from both the biological standpoint and with regard to natural enemies and natural and artificial means of control. Investigations of the life histories of these insects are nearly completed and the principal experiments will be directed toward securing cheap and easily applied methods of control, such as heat and cold and fumigation under different conditions of building and in different portions of the country. Laboratories are established in principal milling centers, wherein experiments may be undertaken on a practical scale, using commercial milling establishments for the tests.

Location.—Sacramento, Cal.; Wichita, Kans.; Washington, D. C.

Date begun.—1908.

Results.—This subject has received constant attention for a number of years, during which time a great number of tests of standard and new fumigants, such as hydrocyanic acid, bisulphid of carbon, and carbon tetrachlorid, have been made with respect to their applicability as insecticides and repellents. Experiments are nearly completed as to the availability of naphthaline for the protection of corn in cribs in the South and are promising excellent results. A campaign of education among millers has been conducted, with the result that mills are more free from grain-infesting insects at the present time than has been the case for years. The source of infestation of flour has been determined to be in most cases the mill, as this is unlikely to occur to any great extent on public conveyors or on board merchant vessels. Mechanical methods for the separation of beetles and their eggs from stored grains and flour promise much, but experiments must be completed before publication. A constant lookout has been kept for newly introduced pests, with the result that several foreign forms injurious abroad have been discovered to be already in the United States.

Assignment.—F. H. Chittenden, C. H. Popenoe, W. H. White.

Proposed expenditure, 1915–16.—$4,000.

Argentine Corn Weevil:

Object.—To collect and determine in different localities the principal insects which are injurious to grain being shipped from Argentina and tropical countries; to determine the principal source of damage, whether in the field, on the docks, or in the ships or other carriers, and where the greatest amount of damage may be accomplished under different conditions and seasons; and to devise means of preventing the enormous losses now being incurred.

Procedure.—The insects principally concerned, as far as can be determined, are the rice weevil or corn weevil of the South and the Angoumois grain moth, both of which, with minor insects, have been carefully studied in regard to their life histories, natural enemies, and other particulars in their occurrence in a climate like that of the District of Columbia. In order to determine the sources of attack, amount of losses, and other details, an expert entomologist should be sent to Argentina to ascertain these points, which are necessary to devise the best methods of control.

Cooperation.—Bureau of Plant Industry and importers about New York harbor and elsewhere.

Results.—With the exception of work which has been done in an entirely preliminary way during the fiscal year 1915 at New York City and vicinity and at Baltimore, Md., the investigation of the insects from the standpoint of their occurrence in Argentine corn has not been completed. Manuscripts have been accumulated on this head and a preliminary account may be available when needed. All possible means of preventing extreme losses, including the employment of various fumigants, some of them new or comparatively so, heat, cold, and other methods, have been tested on a small scale in laboratories and on larger scales elsewhere.

Argentine Corn Weevil—Continued.

Probable date of completion.—1918.

Assignment.—F. B. Milliken, C. H. Popenoe, A. B. Duckett, F. H. Chittenden.

Proposed expenditures, 1915–16.—$4,000.

Total, Investigations of Stored-Product Insects, $8,000.

Total, Truck-Crop and Stored-Product Insect Investigations, $44,620.

[Research.]

TROPICAL AND SUBTROPICAL FRUIT INSECT INVESTIGATIONS.

Supervision:

Object.—General administration and direction of investigations and routine laboratory and clerical work.

Location.—Washington, D. C.

Date begun.—1907.

Assignment.—C. L. Marlatt.

Proposed expenditures, 1915–16.—$4,700.

Citrus-Fruit Insect Investigations in California:

Object.—To perfect the most economical and efficient method of fumigating and spraying citrus groves and citrus nursery stock infested with scale insects and to investigate new and injurious citrus-fruit insects.

Procedure.—Suitable groves are selected in various sections and fumigated and sprayed under the supervision of the leader. Nursery stock is also fumigated in an attempt to establish a definite fumigation schedule for such material. Incidentally, other insects affecting tropical and subtropical fruit trees will be given consideration.

Cooperation.—County horticultural commissioners and Bureau of Chemistry.

Location.—Headquarters, Pasadena, Cal.; citrus belts of southern California.

Date begun.—1907.

Results.—Fumigation methods have been standardized, as indicated in Bureau of Entomology Bulletins 79 and 90.

Probable date of completion.—July 1, 1919.

Assignment.—R. S. Woglum.

Proposed expenditures, 1915–16.—$6,000.

Citrus-Fruit Insect Investigations in Florida:

Object.—To test on a commercial basis the practicability of control measures for the white fly and scale insects, recommended as the result of investigations of previous years; also to investigate the biology, injury, and methods of control of the rust mite and any new or injurious insects affecting citrus trees in Florida.

Procedure.—Suitable groves in various sections of the State will be selected and sprayed in accordance with methods which early experimental work has shown to be most promising. Life-history studies and methods of control will be investigated in the laboratory and in the field. Incidentally other insects affecting tropical and subtropical fruit trees will be given consideration.

Cooperation.—Florida Experiment Station and local grove owners.

Location.—Headquarters, Orlando, Fla., with experimental demonstrations practically throughout the State.

Date begun.—White-fly investigations, in 1907.

Results.—Satisfactory methods of control have been perfected, the life history of the white fly determined, and predaceous and parasitic insects studied. These results are reported in the following bulletins and circulars of the Bureau of Entomology: Bulletin 76, "Fumigation for the Citrus White Fly"; Circular 168, "Spraying for White Flies in Florida"; Bulletin 102, "Natural Control of White Flies in Florida"; Circular 111, "Preparations for Winter Fumigation for the Citrus White Fly"; Bulletin 92, "White Flies Injurious to Citrus in Florida"; also, in Journal of Agricultural Research, vol. 2, No. 6, "Papaya Fruit Fly"; Economic Entomology, vol. 8, No. 2, "Spraying Scheme for the Control of Insect Pests on Citrus Trees in Florida."

Probable date of completion.—July 1, 1919.

Assignment.—W. W. Yothers.

Proposed expenditures, 1915–16.—$4,000.

Citrus-Fruit Insect Investigations in Louisiana:

Object.—To investigate and test various methods of controlling injurious citrus insects in Louisiana.

Procedure.—Careful study is made of the Argentine ant as regards its habits and injuries to citrus trees. Methods of control are under consideration, such as the spraying and banding of trees, ditching, and destruction of ant colonies. Incidentally other insects affecting tropical and subtropical fruit trees will be given consideration.

Cooperation.—Local grove owners.

Location.—New Orleans, La.

Date begun.—1913.

Results.—Methods of controlling the Argentine ant as it affects citrus trees are advised; these have been found of sufficient promise to be now made the subject of general orchard tests.

Probable date of completion.—July 1, 1919.

Assignment.—J. R. Horton.

Proposed expenditures, 1915–16.—$4,000.

Investigations of Insects Affecting Tropical and Subtropical Fruits and Plants in Greenhouses:

Object.—To perfect economical and effective commercial methods of controlling insects affecting tropical and subtropical fruits and plants in greenhouses. Life-history studies will be undertaken when necessary.

Procedure.—Suitable greenhouses are to be selected for testing the principal means of control, namely, fumigation, arsenicals, and sprays.

Cooperation.—Federal Horticultural Board, Bureau of Plant Industry, and Bureau of Chemistry.

Location.—Washington, D. C.

Date begun.—1915.

Probable date of completion.—July 1, 1919.

Assignment.—E. R. Sasscer.

Proposed expenditures, 1915–16.—$2,500.

Investigations of Miscellaneous Subtropical Insects:

Object.—To investigate unusual outbreaks of injurious insects affecting tropical and subtropical plants.

Procedure.—This work is directed from Washington, D. C., and consists mainly in correspondence and in investigations of unusual outbreaks of insects affecting subtropical plants. Incidentally, other insects affecting tropical and subtropical fruit trees will be given consideration.

Location.—Work directed from Washington, D. C.

Date begun.—1913.

Results.—The allotment for this work is used as a reserve fund. During the past year the allotment was turned over to other investigations, in view of the fact that there was no occasion for its use in controlling unusual outbreaks of insects affecting citrus trees.

Probable date of completion.—July 1, 1919.

Assignment.—Special assignment as needed.

Proposed expenditures, 1915–16.—$300.

Total, Tropical and Subtropical Fruit Insect Investigations, $21,500.

[Research.]

BEE-CULTURE INVESTIGATIONS.

Supervision:

Object.—To supervise the research activities and carry on administrative and clerical work necessary for their proper conduct.

Location.—Washington, D. C.

Date begun.—About 1881.

Assignment.—E. F. Phillips.

Proposed expenditures, 1915–16.—$2,560.

Wintering of Bees:

(*a*) Reaction to Winter Changes—

Object.—To determine the various methods by which bees respond to changes in external temperature and other environmental factors.

Procedure.—Careful records are kept of the temperature changes in the colony and hive in conjunction with records of climatic conditions sur-

Wintering of Bees—Continued.

(*a*) Reaction to Winter Changes—Continued.

rounding them. The changes due to temperature have been studied, and meteorological and other environmental factors are now being taken up. The observations so far deal especially with temperature changes due to environmental factors.

Location.—Drummond, Md.

Date begun.—1912.

Results.—The reactions of the normal colony to changes in external temperature and the effects of various irritations determined; published in Department Bulletin 93. The effects of wind velocity and constancy and of changes in humidity of the air immediately surrounding the bees have been determined; not yet published. A large mass of data has been obtained, which is being worked up as rapidly as possible.

Probable date of completion.—1918.

Assignment.—E. F. Phillips, George S. Demuth.

Proposed expenditure, 1915–16.—$2,900.

(*b*) Care During Winter—

Object.—To determine the best methods of caring for bees during winter in all sections of the United States. The purpose of this investigation is to determine the conditions under which bees do the least work in winter, thus conserving their vitality for spring activities.

Procedure.—From the records of activities of colonies in the cellar and of those packed and protected in various ways from adverse weather conditions out of doors the optimum environmental conditions are determined.

Location.—Drummond, Md.

Date begun.—1912.

Results.—Same as preceding subproject. The practical phases have not been discussed in publications, but the data now at hand when fully worked up will yield certain definite practical results. Some of these details will be prepared for publication in the near future.

Probable date of completion.—1918.

Assignment.—E. F. Phillips, George S. Demuth.

Proposed expenditure, 1915–16.—$2,900.

Development of Bees:

Object.—To investigate the morphology of the larva from the hatching of the egg to the beginning of pupation.

Procedure.—Normal larvæ are prepared and microscopically studied. Some details of physiology are also investigated, especially those which have to do with beekeeping practice.

Location.—Drummond, Md.

Date begun.—1913.

Results.—This is a continuation of the investigation of the development of the bee in the egg, the results of which are to be published in book form. The work on the development of the larva is still under way.

Probable date of completion.—1915.

Assignment.—James A. Nelson.

Proposed expenditure, 1915–16.—$1,800.

Sense Organs of Bees:

(*a*) Influence of Odors on Activity—

Object.—To study the influence of odors on the activities of the individual bees and of the entire colony, especially those produced by the bees themselves. The sense of smell is of primary importance in a study of the activities of bees.

Procedure.—Experimental work with bees under control conditions to eliminate or intensify normal odors.

Location.—Drummond, Md.

Date begun.—1913.

Results.—The various odors of the colony have been differentiated more clearly than formerly. No published results.

Probable date of completion.—1916.

Assignment.—N. E. McIndoo.

Proposed expenditure, 1915–16.—$100.

(*b*) Structure and Functions—

Object.—To determine the structure and functions of the sense organs of the bee as a foundation for a study of bee behavior.

Sense Organs of Bees—Continued.

(*b*) STRUCTURE AND FUNCTIONS—Continued.

Procedure.—The various sense organs are being located on all parts of the bee and their microscopic structure studied. Experimental evidence as to their function is being obtained.

Location.—Drummond, Md.

Date begun.—1913.

Results.—The structure of the olfactory organs has been determined and results published in a technical journal. The organs on the mouth parts have also been studied.

Probable date of completion.—1918.

Assignment.—N. E. McIndoo.

Proposed expenditure, 1915–16.—$600.

Effects on Bees of Spraying Fruit Trees:

Object.—To determine whether bees are killed by spraying fruit trees for codling-moth control; and, if so, through what means and under what conditions.

Procedure.—Observations of colonies of bees will be made in or near sprayed orchards.

Location.—Various bureau field stations.

Date begun.—1914.

Results.—In 1914 orchards were purposely sprayed in full bloom to determine how bees are killed by arsenicals. In 1915 observations were made under conditions of commercial spraying. Final results not yet obtained.

Probable date of completion.—1916.

Assignment.—N. E. McIndoo.

Proposed expenditure, 1915–16.—$400.

Diseases of Bees:

(*a*) ETIOLOGY OF BEE DISEASES—

Object.—To determine the causes of the diseases of bees.

Procedure.—Bacteriological examinations are made of diseased material and inoculation of healthy colonies made with various microorganisms.

Location.—Washington, D. C.

Date begun.—1907.

Probable date of completion.—September, 1916.

Assignment.—G. F. White.

Proposed expenditure, 1915–16.—$2,500.

(*b*) DISTRIBUTION AND CONTROL OF BEE DISEASES—

Object.—To learn where the various bee diseases are now located and to devise means of treatment and control.

Procedure.—Suspected material from various localities is examined; cooperation is maintained with beekeepers in the improvement of apiary inspection; experiments are under way on the treatment of diseased colonies.

Location.—Drummond, Md.

Date begun.—1907.

Results.—The distribution of American foul brood and European foul brood is known and results will soon be published. Apiary inspection has been greatly increased through the activities of the office.

Probable date of completion.—1918.

Assignment.—A. H. McCray.

Proposed expenditure, 1915–16.—$2,000.

Wax Production:

Object.—To determine the optimum conditions under which wax is secreted by the bees.

Location.—Austin, Tex.

Date begun.—1913.

Results.—Preliminary experiments only have so far been made. The work has been discontinued until such time as more attention can be devoted to it at the bureau bee-culture laboratory. Funds are not now available for an extended study.

Assignment.—D. B. Casteel.

Proposed expenditures, 1915–16.—No allotment; work temporarily suspended.

Survey in Beekeeping:

Object.—To survey a State by counties to determine sources and character of honey, time of honey flow, manipulations needed to obtain maximum returns, and the present status of beekeeping.

Procedure.—A preliminary inspection trip through the State will be made, visiting leading beekeepers to obtain general information on the subjects mentioned under "Object." Using this information as a basis, a careful survey of a given county for detailed information will be made, with the assistance of the county agent and interested beekeepers. Upon completion of the work in one county, similar work will be taken up in another county, noting differences in condition, in flora, altitude, etc. Upon completion of the work for the State, the data obtained will be put in bulletin form, giving results of the survey with reference to possibilities of beekeeping and methods to be practiced.

Cooperation.—States Relations Service.

Location.—Headquarters, Washington, D. C. Location of field work not yet determined.

Date begun.—1915.

Assignment.—E. F. Phillips.

Proposed expenditures, 1915–16.—$600.

Total, Bee-Culture Investigations, $16,360.

[Research.]

MISCELLANEOUS INSECT INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—To supervise the investigations and carry on administrative and clerical work necessary for their practical conduct.

Location.—Washington, D. C.

Date begun.—1879.

Assignment.—L. O. Howard, W. D. Hunter.

Proposed expenditures, 1915–16.—Cost nominal; work incidental to the project "General Administration."

IDENTIFICATION AND CLASSIFICATION OF INSECTS.

Identification and Classification of Insects:

Object.—Identification and classification of insects, including anatomical and biological work of a general character. The work under this project forms the basis for many of the investigations of the bureau. It supplies the fundamental information necessary before field investigations can be prosecuted. It also provides a reference section for the comparison of specimens and aids State entomologists and others in the general promotion of entomology and the control of injurious species.

Procedure.—Competent specialists are placed in charge of the collections at the U. S. National Museum, who determine all material which is sent in. Practically every year some unexpected and unusual outbreak occurs, frequently of some insect which has not been carefully studied, making it necessary to conduct immediate field investigations. Such funds as are needed for this emergency investigation are as a rule drawn from this allotment, and the special experts of the identification-work assignment are used in such cases so far as possible.

Cooperation.—U. S. National Museum, which houses the collections and provides working rooms.

Location.—Washington, D. C.

Date begun.—1897.

Results.—Used in correspondence, in publications of the bureau, and by employees engaged in biological studies in the field.

Assignment.—Nathan Banks, A. N. Caudell, H. G. Dyar, Otto Heidemann, Frederick Knab, Theodore Pergande, E. A. Schwarz, Rolla P. Currie, and A. A. Girault.

Proposed expenditures, 1915–16.—$26,471.

INVESTIGATIONS OF INSECTS AFFECTING THE HEALTH OF MAN.

Eradication of Spotted-Fever Tick in Montana:

Object.—To reduce or eradicate spotted fever in the Bitter Root Valley of Montana by control of the tick which transmits it.

Procedure.—Systematic weekly dipping of large domestic animals in the lower half of the Bitter Root Valley will be carried on during the months when the adult ticks are present on hosts. Careful observations will be made during the work to ascertain the best conditions for dipping and all possible modifications of the methods that may be more efficient. Careful biological studies of the ticks are made and also seasonal studies. Educational work is carried on incidentally, to enlighten the farmers regarding the dangers of the tick and the best methods of getting rid of it. Experiments with spring and fall burning over of pastures are made to test the effect on tick destruction and ultimate control. The killing of ground squirrels and other rodents that act as hosts for the immature stages of the tick is encouraged.

Cooperation.—Montana State Board of Entomology, State Entomologist of Montana, Public Health Service, Bureau of Biological Survey. and State Board of Health of Idaho.

Location.—Bitter Root Valley, Mont.

Date begun.—1913.

Results.—Considerable progress has been made in the extermination of the ticks, and the work has been received very favorably by the people in the Bitter Root Valley.

Assignment.—W. D. Hunter, R. A. Cooley, W. V. King.

Proposed expenditures, 1915-16.—$8,319.

Relation of Malaria Mosquitoes to Agriculture in the South:

Object.—To determine the requirements for the protection of individuals on plantations and elsewhere against malaria mosquitoes.

Procedure.—An estate of 20,000 acres situated at Mound, La., has been selected for an intensive study of mosquitoes of that region and their relationships to agricultural problems. Comparative studies will be made at other points.

Cooperation.—Maxwell-Yerger Plantation Co., Mound, La.

Location.—Mound, La.; Scott, Ark.; and points in Mississippi.

Date begun.—1913.

Results.—A careful preliminary survey has already been made of the plantation and the past malarial history correlated with the productiveness of the plantation. A careful estimate has also been made, based upon observations of the actual cost of malaria to one of the plantation units in the reduction of productiveness.

Assignment.—D. L. Van Dine, A. H. Jennings, H. H. Kimball, J. K. Thibault, jr.

Proposed expenditures, 1915-16.—$7,010.

House-Fly Control in Manure:

Object.—To determine means of controlling the house fly in manure without destroying the fertilizer value.

Procedure.—Large-scale experiments with various chemicals are being conducted at various places. Manure treated with these chemicals is later tested for its fertilizer value by analysis and also by field tests.

Cooperation.—Bureaus of Chemistry, Plant Industry, and Animal Industry; the Maryland Agricultural College; and the Louisiana State Sugar Experiment Station.

Location.—Drummond, College Park, and Bethesda, Md.; New Orleans, La.

Date begun.—1913.

Results.—The experiments have proved the efficacy of borax in manure which is not to be used in fertilizing, and of hellebore in manure to be used as a fertilizer.

Assignment.—R. H. Hutchison.

Proposed expenditures, 1915-16.—$2,550.

Total, Investigations of Insects Affecting the Health of Man, $20,379.

Control of the House Fly and Other Insects in Establishments Operating under Federal Meat Inspection:

Object.—To devise plans for the control and eradication of the house fly and other insects under the special conditions existing in establishments operating under Federal meat inspection.

Procedure.—After a tour of inspection of the larger meat-packing establishments an agent will be established at Fort Worth, Tex., to inaugurate special studies and experiments in the control of all insects found in and around packing houses. The breeding work will be done at the laboratory at Dallas, Tex.

Cooperation.—Bureau of Animal Industry and establishments operating under Federal meat inspection.

Location.—Fort Worth and Dallas, Tex.; Chicago, Ill.; Kansas City, Mo.; Omaha, Nebr.

Date begun.—April 10, 1915.

Assignment.—F. C. Bishopp and E. W. Laake, of the Bureau of Entomology, and George H. Shaw, of the Bureau of Animal Industry.

Proposed expenditures, 1915–16.—$2,500.

INVESTIGATIONS OF INSECTS AFFECTING THE HEALTH OF ANIMALS.

Life-History Investigations of Cattle-Fever Tick:

Object.—To obtain information that will be of material use in the general work of eradication of the cattle tick from the United States now under way and in the reduction of the number of the pests in regions that can not be reached for many years by the general plan of eradication.

Procedure.—The host relation, distribution, and longevity of the tick in its various stages are being studied. In this work a number of experimental animals are used to determine host relations and length of developmental periods.

Cooperation.—Tennessee and Louisiana experiment stations, Bureau of Animal Industry, and individual cattle owners in the State of Texas.

Location.—Dallas, Victoria, and Uvalde, Tex.

Date begun.—1904.

Results.—A very complete and efficient system of eradication by pasture rotation and improved methods of eradication by insecticides have been devised.

Assignment.—F. C. Bishopp, D. C. Parman, J. D. Mitchell.

Proposed expenditures, 1915–16.—$2,000.

Investigations of Ticks Other than Cattle Ticks and Spotted-Fever Tick:

Object.—To determine the relation of these pests to other hosts, the biology of the species, and feasible means of controlling them.

Procedure.—This project is divided into subprojects as follows: (1) The fowl tick, (2) the Spinose ear tick, (3) the Lone Star tick, (4) the winter tick, (5) the Gulf coast tick, and (6) other species. The life histories, habits, host relation, and seasonal histories of each species is being worked out. In this work various host animals are infested and the development of the ticks noted, the length of the various developmental periods when not on hosts determined, and the period necessary to destroy by starvation obtained. Methods by which these injurious species are likely to be spread are also being considered.

Cooperation.—Cooperation has been arranged by the Bureau of Animal Industry to investigate the possible occurrence of Spirochetosis of fowls in the United States, to determine the effects of killing mixtures found to be favorable tickicides upon the health of the host, and to determine the extent to which these mixtures can be used in the practical work of control.

Location.—Dallas, Victoria, and Uvalde, Tex.; Bitter Root Valley, Mont.

Date begun.—1905.

Results.—The life histories of several ticks have been quite completely determined and extensive bulletins published.

Assignment.—F. C. Bishopp, H. P. Wood, J. D. Mitchell, E. W. Laake, D. C. Parman, W. E. Dove.

Proposed expenditures, 1915–16.—$1,920.

Stable Fly:

Object.—To study the life history of the stable fly and to devise methods of control by artificial and natural means.

Procedure.—All features of the life history of the pest are studied to determine where attack can be directed against it. Especial attention is directed to local outbreaks. Observations will be made in localities where pernicious anemia of horses is known to occur, in order to establish, if possible, the relationship of the abundance of these flies to the acuteness of the disease. The investigation of the utilization of parasites and practical control measures will be conducted.

Cooperation.—Cooperation is arranged with the Bureau of Animal Industry to determine the extent to which Texas fever becomes acute as a result of the attack of this fly, and also, if possible, to determine the relationships of pernicious anemia to horses. Cooperation has also been obtained with the Hawaiian Experiment Station by breeding and shipping parasites to that station.

Location.—Dallas, Tex.

Date begun.—1912.

Results.—The utility and means of propagation of certain parasites have been determined.

Assignment.—F. C. Bishopp.

Proposed expenditures, 1915–16.—$1,000.

Screw Worms:

Object.—To determine the various species of flies which attack animals and man, causing various types of myiasis, and the conditions favoring such infestation; to determine the life histories, seasonal activity, and habits of these flies, and to test methods of control.

Procedure.—Larvæ from infested animals and man are collected and reared and the character and conditions prior to infestation studied. Experiments will be conducted to test the relative effectiveness of different repellents on various species of screw-worm flies. The Bureau of Animal Industry will cooperate in experiments in the destruction of the larvæ in living animals.

Cooperation.—Bureau of Animal Industry and various physicians.

Location.—Dallas, Tex.

Date begun.—1914.

Results.—Only preliminary observations have been made.

Probable date of completion.—1920.

Assignment.—F. C. Bishopp.

Proposed expenditures, 1915–16.—$500.

Horseflies:

Object.—To determine feasible means of controlling the various species of horseflies, and thus reducing the annoyance to man and animals and the dangers of spreading anthrax among animals and to man.

Procedure.—The extent of loss due to horseflies by disease transmission, worry, and other factors will be studied. The life histories of all species will be investigated and practical methods of control determined.

Cooperation.—Bureau of Animal Industry and State Board of Health of Texas.

Location.—Dallas, Tex., and various points in Montana, North Dakota, and South Dakota.

Date begun.—1914.

Results.—Only preliminary studies have been made.

Probable date of completion.—1920.

Assignment.—W. E. Dove.

Proposed expenditures, 1915–16.—$1,000.

Horn Fly:

Object.—To devise and improve methods of horn-fly control especially applicable to conditions in the South.

Procedure.—The life history and habits are being studied, and the longevity of adults and method of hibernating are being given particular attention. Special attention is given to the value of systematic collecting and spreading of manure on fields at dairies. Tests are being made of the utiliza-

Horn Fly—Continued.
tion of manure-inhabiting insects which either destroy the immature flies directly or cause the drying out of the manure and their destruction thereby.
Cooperation.—The Bureau of Animal Industry will cooperate by conducting studies of the effects of substances applied to animals and in determining the effects of attack on milk and beef production. The Porto Rico Experiment Station collects and forwards insects found useful in combating the horn fly.
Location.—Dallas, Tex.
Date begun.—1914.
Results.—Only preliminary results have been obtained.
Probable date of completion.—1920.
Assignment.—F. C. Bishopp.
Proposed expenditures, 1915–16.—$500.

Ox Warbles:
Object.—To determine the present status of ox warbles in the United States and to investigate the life histories, habits, and seasonal histories, as well as the distribution of these species.
Procedure.—This work will be mainly conducted at dairies near Dallas, Tex., and on ranches in the vicinity of Uvalde and Victoria, Tex., where warbles can be obtained directly from the animals and their life histories and the effects of injury studied more accurately.
Cooperation.—The effect of extracting the larvæ and dipping the host will be studied by the Bureau of Animal Industry.
Location.—Dallas, Uvalde, and Victoria, Tex.
Date begun.—1914.
Results.—Only preliminary information has been obtained.
Probable date of completion.—1920.
Assignment.—F. C. Bishopp.
Proposed expenditures, 1915–16.—$200.

Chicken Flea:
Object.—To accumulate information on the life history, habits, distribution, and injuriousness of the insect and how it may be controlled.
Procedure.—The life-history work will be conducted in cage experiments, using chickens, dogs, and rabbits as hosts. Various methods of treating the chicken yards and also the animals will be studied.
Cooperation.—The Bureau of Animal Industry will cooperate in work relating to the treatment of animals. Various individuals are cooperating by sending in host and locality records and other valuable information.
Location.—Dallas, Tex.
Date begun.—1914.
Results.—Only preliminary results have been obtained.
Probable date of completion.—1920.
Assignment.—F. C. Bishopp.
Proposed expenditures, 1915–16.—$200.

Miscellaneous Insects Affecting Live Stock:
Object.—To devise means of control of various insect pests affecting live stock, including bot flies, buffalo gnats, the chicken bug of the Southwest, chicken mites, and other animal and poultry insects.
Procedure.—Information will be gathered as opportunity offers from time to time, especially during outbreaks of the various pests.
Cooperation.—Bureau of Animal Industry.
Location.—Dallas, Tex.
Date begun.—1912.
Results.—Considerable preliminary information has been gathered.
Assignment.—F. C. Bishopp.
Proposed expenditures, 1915–16.—$350.

Total, Investigations of Insects Affecting the Health of Animals, $7,670.

Total, Miscellaneous Insect Investigations, $54,520.

INVESTIGATION OF THE MEDITERRANEAN FRUIT FLY.

Supervision:

Object.—General control and direction of the various projects and the conduct of the administrative office.
Location.—Washington, D. C.
Date begun.—1912.
Assignment.—C. L. Marlatt.
Proposed expenditures, 1915–16.—$5,000 (research, $2,000; regulation, $3,000).

[Regulation.]

Control of Foreign Fruits Offered for Entry:

Object.—Inspection and regulation of entry of fruit imported into the United States from Mediterranean and other countries in which the fruit fly is known to occur.
Procedure.—Fruits likely to be infested with the fruit fly are inspected at various ports of entry.
Cooperation.—Federal Horticultural Board, United States postal service and customs service, State inspectors, and inspection services of foreign countries.
Location.—Washington, D. C., and ports of entry.
Date begun.—1912.
Results.—The information gained as to the possibility of the fruit fly entering the United States with imported fruits will be used as a basis for the necessary quarantine.
Assignment.—C. L. Marlatt.
Proposed expenditures, 1915–16.—$5,000.

Control of Export Hawaiian Fruit:

Object.—Inspection and certification of pineapples and bananas for export from Hawaii to the mainland of the United States under quarantine No. 13, and general enforcement of that quarantine.
Procedure.—Ranches from which pineapples and bananas are to be exported to the mainland of the United States are inspected and certified. Fruits entering the ports of the Pacific coast are inspected in cooperation with the Federal Horticultural Board.
Cooperation.—Hawaiian Territorial Board of Agriculture, State inspectors, and United States postal service and customs service.
Location.—Honolulu, Hawaii; San Francisco, Cal.; and other Pacific ports.
Date begun.—1912.
Results.—Full control effective under regulations.
Assignment.—E. A. Back.
Proposed expenditures, 1915–16.—$10,000.

[Research.]

Investigations of Foreign Fruit Offered for Entry:

Object.—Investigations of fruits likely to be imported into the United States from Mediterranean or other countries in which the fruit fly is known to occur, as a basis for any necessary quarantine action.
Procedure.—Inspection is made of fruits originating in various Mediterranean countries in which the fruit fly is known to occur.
Cooperation.—Federal Horticultural Board.
Location.—Washington, D. C., and ports of entry in foreign countries.
Date begun.—1912.
Results.—Data in Department Bulletins 134, "Citrus Fruit Insects in Mediterranean Countries," and 161, "The Mediterranean Fruit Fly in Bermuda."
Assignment.—C. L. Marlatt.
Proposed expenditures, 1915–16.—$5,700.

Life-History Studies of the Fruit Fly:

Object.—To study the life history of the fruit fly in relation to its hosts, looking to means of control, including temperature studies and cooperation in the distribution of parasites introduced from foreign countries.
Procedure.—The usual methods adopted in life-history studies are followed, including a study of the preferred hosts of the fruit fly. Various means

Life-History Studies of the Fruit Fly—Continued.

of control are under consideration, and parasites as they are introduced are kept under observation.

Cooperation.—Hawaiian Territorial Board of Agriculture.

Location.—Honolulu, Hawaii.

Date begun.—1912.

Results.—Life-history and temperature studies are well advanced. The following publications have appeared during the past year: "Susceptibility of Citrous Fruits to the Attack of the Mediterranean Fruit Fly," Journal of Agricultural Research, vol. 3, No. 4; "Life History of the Mediterranean Fruit Fly from the Standpoint of Parasite Introduction," Journal of Agricultural Research, vol. 3, No. 5.

Probable date of completion.—1919.

Assignment.—E. A. Back.

Proposed expenditures, 1915–16.—$7,500.

Total, Investigations of the Mediterranean Fruit Fly, $33,200 (research, $15,200; regulatory, $18,000).

GIPSY MOTH AND BROWN-TAIL MOTH INVESTIGATIONS.

SUPERVISION.

Supervision:

Object.—To supervise and direct the scientific and practical activities and business affairs of the gipsy moth and brown-tail moth investigations, including miscellaneous office, laboratory, and storehouse expenses, general supplies, and fixed charges which can not be readily prorated against the various projects, such as requisitions and accounts, rents, and express, freight, telegraph, and telephone charges.

Cooperation.—Federal Horticultural Board, Forest Service, and various State entomologists, foresters, and nursery inspectors.

Location.—Principal office, Boston, Mass. Principal laboratory, Melrose Highlands, Mass. The infested territory covers about one-third the area of New England; isolated colonies occur also in New York and Ohio.

Date begun.—1906.

Assignment.—A. F. Burgess.

Proposed expenditures, 1915–16.—$20,860 (research, $17,086; regulation, $3,744).

[Research.]

LABORATORY AND FIELD INVESTIGATIONS.

Insects Parasitic on Moths:

Object.—To study the habits and life histories of the imported parasites and natural enemies of the gipsy and brown-tail moths; to determine the extent to which these parasites are increasing under field conditions in this country and ascertain their values as enemies of the insects concerned; also to collect and colonize the beneficial species in areas where they do not now exist in the infested territory.

Procedure.—Parasites and natural enemies of the gipsy moth and brown-tail moth have been introduced into New England from European countries and Japan. Colonies have been liberated in the worst infested areas in the field, and collections are made from year to year in order to determine the increase or decrease of the parasites and their hosts, and also for the purpose of securing material for liberating colonies in parts of the infested region where these beneficial species do not exist. In connection with this work it is necessary to study carefully the life histories and habits of the natural enemies concerned, in order that the work may be carried on intelligently. The interrelations between the parasites and their hosts, as well as factors in this country which may be responsible for decrease in parasitism, must also be carefully investigated.

Cooperation.—State experiment stations, entomologists, and moth superintendents in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

Location.—Portland, Me.; Melrose Highlands, Mass.; and a large number of localities in the New England States, where parasitic material has been liberated.

Insects Parasitic on Moths—Continued.

Date begun.—1906.

Results.—Information has been disseminated as to the character and habits of the parasites imported and their value in moth control. The introduction feature of the work is practically completed.

Assignment.—J. N. Summers, S. S. Crossman.

Proposed expenditures, 1915–16.—$25,000.

Natural Increase of the Gipsy Moth under Field Conditions:

Object.—To determine the natural increase of the gipsy moth under field conditions and the relation of food plants, natural enemies, etc., to the control of this insect.

Procedure.—Studies are being made in about 200 selected infested areas, in order to determine the natural increase of the gipsy moth under field conditions. Selections are made in different types of woodland in places where parasites have been introduced, to check against other localities where none existed. The effect of defoliation on tree growth is carefully noted and definite records kept from year to year on the increase or decrease of the moth under field conditions.

Location.—Maine, New Hampshire, and Massachusetts.

Date begun.—1911.

Results.—Several relations of natural enemies to moth increase determined.

Probable date of completion.—February 1, 1917.

Assignment.—C. W. Minott.

Proposed expenditures, 1915–16.—$20,000.

Feeding Habits of the Gipsy Moth:

Object.—To determine the feeding habits of gipsy-moth larvæ in all stages and the food plants upon which this species can not develop.

Procedure.—This work has been carried on by means of feeding gipsy-moth caterpillars in each stage on the common plants which occur in New England. The results of this work are checked by field observations.

Location.—Melrose Highlands, Mass.

Date begun.—1912.

Results.—The relation of food plants to the increase of the gipsy moth has been partially determined. A report covering most of the experiments is now in press.

Probable date of completion.—January 1, 1916.

Assignment.—F. H. Mosher.

Proposed expenditures, 1915–16.—$4,000.

Relation of Wilt to Gipsy-Moth Control:

Object.—To determine the identity of the disease known as the "wilt" and its relation and effect on the increase of the gipsy moth.

Procedure.—Technical laboratory studies are being carried on to determine the identity of the organism. Field observations to determine the relation of temperature and humidity to the prevalence and increase of the disease are also undertaken during the summer.

Cooperation.—Bussey Institution of Harvard University.

Location.—Melrose Highlands and Forest Hills, Mass.

Date begun.—1912.

Results.—Information has been secured on the dissemination of this disease; also much information as to its identity.

Probable date of completion.—January 1, 1917.

Assignment.—R. W. Glaser, J. W. Chapman, A. W. Young.

Proposed expenditures, 1915–16.—$8,000.

Secondary Insects:

Object.—To determine the effect of secondary insects on trees that have been defoliated by the gipsy moth.

Procedure.—This work is being carried on principally through field observations, which are made as opportunity permits in the infested area. Records of injury to trees are being collected, a considerable amount of data is being secured in the field, and a few laboratory experiments on the life histories of secondary insects are being conducted.

Location.—Selected areas in Maine, New Hampshire, and Massachusetts.

Date begun.—1913.

Results.—The relation of secondary insects to the death of defoliated trees has been partially determined.

Secondary Insects—Continued.

Probable date of completion.—1916.

Assignment.—H. A. Preston.

Proposed expenditures, 1915–16.—$700.

Dispersion of Gipsy Moth:

Object.—To determine the means by which the gipsy moth spreads to new territory.

Procedure.—The information in regard to the dispersion of the gipsy moth is secured principally by using large screens coated with "tanglefoot," upon which are caught small caterpillars of the gipsy moth that are transported by the wind.

Location.—Selected areas in Maine, New Hampshire, and Massachusetts.

Date begun.—1911.

Results.—The relation of air currents to the dispersion of gipsy-moth caterpillars has been determined; published in Bureau of Entomology Bulletin 119.

Probable date of completion.—1916.

Assignment.—C. W. Collins.

Proposed expenditures, 1915–16.—$4,000.

Introduction of Natural Enemies:

Object.—To carry on such work in foreign countries as may be necessary to secure natural enemies or information on parasites and diseases of the brown-tail and gipsy moth.

Procedure.—Arrangements will be made, if possible, to secure collections of certain parasites of the gipsy and brown-tail moths, which have been received only in small numbers.

Cooperation.—Entomologists in foreign countries.

Date begun.—1906.

Results.—About 30 species of parasites and natural enemies have been introduced, and of these 7 species are increasing and assisting in controlling the gipsy moth and the brown-tail moth.

Assignment.—A. F. Burgess.

Proposed expenditures, 1915–16.—$2,000.

Testing Insecticides and Material for Banding Trees:

Object.—To test new insecticides and methods of spraying or banding trees, in order to enable control work to be carried on more efficiently and economically.

Procedure.—New insecticides will be given field and laboratory tests for the purpose of determining whether the use of any of them is feasible.

Location.—Melrose Highlands, Mass.

Date begun.—1914.

Assignment.—A. F. Burgess.

Proposed expenditures, 1915–16.—$2,000.

Total, Laboratory and Field Investigations, $67,500.

SCOUTING AND EXTERMINATION WORK.

Scouting and Extermination Work:

Object.—To determine the area infested by the gipsy moth and the brown-tail moth, for the purpose of preventing the spread of these insects and to apply exterminative measures in the territory where the best results can be secured in suppressing these pests.

Procedure.—Careful examinations are made by trained men of the towns immediately outside the area known to be infested by the gipsy moth, in order to determine the spread of this insect. In the region from Lake Winnepesaukee to Long Island Sound the towns along the infested border are carefully treated each year, in order to hold back the spread of infestation as much as possible. Careful examinations are made of isolated colonies outside the solid infested area in New England, and treatment is applied whenever the States concerned are unable to bear the expense of all the work.

Cooperation.—State entomologists, foresters, and moth superintendents in the States concerned.

Location.—New England, New York, New Jersey, and Ohio.

Scouting and Extermination Work—Continued.

Results.—The spread of the gipsy moth is determined annually, and many infestations in the outside territory have been exterminated.

Assignment.—L. H. Worthley.

Proposed expenditures, 1915–16.—$164,360.

RELATION OF SILVICULTURE TO GIPSY-MOTH CONTROL.

Relation of Silviculture to Gipsy-Moth Control:

Object.—To determine the relation of silvicultural condition to gipsy-moth infestation, and to demonstrate the best methods of handling forest growth so as to render it unfavorable to gipsy-moth attack; to determine the most profitable utilization of products cut.

Procedure.—In order to carry on this work sample plats have been selected and thinned to different percentages of favored and unfavored food.

Cooperation.—Forest Service, State foresters, entomologists, and moth superintendents in the infested territory.

Location.—Selected wood lots in the infested territory in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

Date begun.—1913.

Results.—Experiments have not been conducted for a sufficient length of time to show permanent results.

Assignment.—G. E. Clement.

Proposed expenditures, 1915–16.—$17,000.

[Regulation.]

QUARANTINE AND INSPECTION OF NURSERY, FOREST, AND QUARRY PRODUCTS.

Quarantine and Inspection of Nursery, Forest, and Quarry Products:

Object.—To provide for the inspection of plants and forest and quarry products in order to prevent the dissemination of the gipsy moth and the brown-tail moth from infested areas.

Procedure.—All products mentioned above are inspected by competent assistants and certified to be free from gipsy-moth and brown-tail moth infestation before they are allowed to be moved to points outside the infested area.

Cooperation.—Federal Horticultural Board and State entomologists and inspectors in the infested territory.

Location.—Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

Date begun.—1912.

Results.—This work has resulted in preventing the spread of the gipsy moth and the brown-tail moth in many localities outside of the present infested area.

Assignment.—D. M. Rogers.

Proposed expenditures, 1915–16.—$52,000.

Total, Glysp Moth and Brown-Tail Moth Investigations, $321,720 (research, $265,976; regulation, $55,744).

BUREAU OF BIOLOGICAL SURVEY.

GENERAL ADMINISTRATION.

Office of Chief:

Object.—The effective direction of the business and other activities of the Bureau of Biological Survey.

Cooperation.—Other Federal bureaus, departments, boards, and commissions.

Location.—Washington, D. C.

Date begun.—1885.

Assignment.—H. W. Henshaw, E. W. Nelson.

Proposed expenditures, 1915–16.—$17,300.

Office of Chief Clerk:

Object.—General supervision of the fiscal affairs of the bureau and of the clerical force and janitor service; the handling of mails; operation and maintenance of central file and property room; all matters pertaining to appointments, pay rolls, and leaves of absence.

Cooperation.—Other offices of the department and other departments.

Location.—Washington, D. C.

Date begun.—1911.

Assignment.—Ada B. Morrison.

Proposed expenditures, 1915–16.—$18,090.

Total, General Administration, $35,390 (research, $11,690; extension, $200; regulation, $23,500).

GAME PRESERVATION.

Supervision:

Object.—The organization and conduct of the activities of this project group, including correspondence, information files, and relations to other organizations in allied work.

Cooperation.—National Association of Audubon Societies.

Location.—Washington, D. C.

Date begun.—1905.

Assignment.—T. S. Palmer.

Proposed expenditures, 1915–16.—$10,050 (research, $500; extension, $250; regulation, $9,300).

[Regulation.]

Interstate Commerce in Game:

Object.—The enforcement of sections 242 and 243 of the Criminal Code of the United States regulating interstate shipment of game.

Procedure.—Field investigations of interstate traffic in game killed or shipped in violation of State laws; securing evidence of violations from individuals, dealers, and transportation companies, and submitting such evidence to the Solicitor's office for transmission to the Department of Justice.

Cooperation.—Solicitor's office, Department of Justice, and State game officials.

Location.—Throughout the United States, but mainly in the Mississippi Valley, Middle and South Atlantic and Pacific Coast States, Arkansas, Missouri, Illinois, New York, New Jersey, Maryland, Virginia, North Carolina, and California.

Date begun.—1900.

Results.—Through prosecutions and warnings a large number of offenders have stopped violating the law and most of the express companies are refusing to accept illegal shipments. Twenty-seven cases reported to the Solicitor during the past nine months and a large number of cases now under investigation.

Assignment.—T. S. Palmer.

Proposed expenditures, 1915–16.—$7,800.

Importation of Foreign Birds and Mammals:

Object.—To prevent the introduction from foreign countries of injurious species of birds and mammals.

Procedure.—The employment of six experienced scientific men at main ports of entry to make inspections of shipments of imported birds and mammals, to identify the species in such shipments, and determine whether any of them are prohibited from entry under section 241 of the Criminal Code of the United States.

Cooperation.—Customs Service, Treasury Department, and Bureau of Animal Industry.

Location.—Washington, D. C., New York, Philadelphia, San Francisco, Honolulu, and other ports when necessary.

Date begun.—1900.

Results.—Prevention of the admission of numerous species of birds and mammals which might become destructive pests, such as the mongoose and others.

Assignment.—T. S. Palmer.

Proposed expenditures, 1915–16.—$1,000.

Inspection and Quarantine of Quail:

Object.—To prevent the introduction of quail disease from northern Mexico among game birds in the United States.

Procedure.—A quarantine and inspection service is maintained over all shipments of quail from Mexico during the season when such importations are permitted.

Cooperation.—Bureau of Animal Industry.

Location.—Eagle Pass, Brownsville, or other points in Texas on the Rio Grande, to be determined later.

Date begun.—1914.

Results.—Quarantine and inspections made of shipments covering 3,340 quail up to January 6, 1915, when disease was discovered and further importations were prohibited.

Assignment.—T. S. Palmer.

Proposed expenditures, 1915–16.—$1,000.

General Maintenance of Reservations and Refuges:

Object.—To preserve and perpetuate the bird life of the country, as well as game mammals, for the benefit of the public, both from an economic and recreational standpoint.

Procedure.—An inspection and warden service is maintained and general supervision exercised over the bird and mammal preserves or reservations in charge of the Department of Agriculture.

Cooperation.—War Department, Navy Department, United States Coast Guard, Bureau of Fisheries, Forest Service, National Association of Audubon Societies, National Bison Society, Boone and Crockett Club, State game officials, and individuals.

Location.—At reservations in 18 States, Alaska, Hawaii, and Porto Rico.

Date begun.—1909.

Results.—Protection of Federal bird and game preserves, improvement of conditions thereon, and a general increase of bird life reported from practically all the reservations; also a satisfactory increase of game animals on refuges; preservation from decrease of some important species.

Assignment.—T. S. Palmer.

Proposed expenditures, 1915–16.—$12,100.

Montana National Bison Range:

Object.—Care of buffalo and other big game animals now on or which may be transferred to the range.

Procedure.—Permanent warden service is maintained. The animals on the range are cared for, hay is stored for winter use, the water supply is kept in good order, and fences and buildings are kept in repair.

Cooperation.—Reclamation Service.

Location.—Dixon, Mont.

Date begun.—1908.

Results.—Buildings and fences repaired and irrigating ditches improved. All animals on the range are in excellent condition, and the bison herd has increased from the original 28 head to over 120.

Assignment.—T. S. Palmer.

Proposed expenditures, 1915–16.—$1,950.

Wind Cave National Game Preserve:

Object.—The maintenance of a national game preserve in the Wind Cave National Park.

Procedure.—The fences and buildings are to be kept in repair and an efficient warden service maintained to protect the game animals located thereon.

Cooperation.—Department of the Interior, National Bison Society, and Boone and Crockett Club.

Location.—Wind Cave National Park, S. Dak.

Date begun.—1912.

Results.—The purchase of an additional tract of land containing 60.11 acres, with suitable buildings thereon for warden's quarters; the construction of a permanent fence of 8.67 miles of 88-inch woven-wire fencing inclosing 4,160 acres; the construction of suitable sheds for the buffalo and elk; and the addition of 13 antelope from Brooks, Alberta, Canada, a gift from the Boone and Crockett Club.

Assignment.—T. S. Palmer.

Proposed expenditures, 1915–16.—$1,500.

Winter Elk Refuge:

Object.—To insure perpetuation of the elk in Wyoming by the establishment of a permanent winter refuge, on which sufficient hay may be raised for the animals, and a free range thence to summer feeding grounds.

Procedure.—The acquiring of land for a winter range and to produce hay sufficient to insure feed for the elk herds during severe winters in order to prevent great losses by starvation; this includes the fencing and maintenance of the hay lands in productive condition, the gathering and stacking of the crop, and feeding the elk when necessary in winter.

Location.—Jackson Hole, Wyo.

Date begun.—1912.

Results.—One thousand two hundred and forty acres have already been purchased, and negotiations are now under way for the purchase of 520 acres of additional land. The reservation of 840 acres of public land as an addition to the refuge has also been made.

Assignment.—T. S. Palmer.

Proposed expenditures, 1915–16.—$16,100 ($13,000 carried over from fiscal year 1915).

Sullys Hill National Game Preserve:

Object.—The establishment of a game preserve in the Sullys Hill National Park for the preservation of birds and game mammals.

Procedure.—The construction of a suitable inclosure, including necessary corrals, sheds, and buildings, for the proper care and maintenance of animals and birds to be placed therein.

Cooperation.—Department of the Interior, National Bison Society, and State game officials.

Location.—Sullys Hill National Park, N. Dak.

Date begun.—1914.

Results.—A bid has been accepted and contract awarded for the construction of a suitable fence about 6 miles in length, including furnishing of materials.

Probable date of completion.—January 1, 1916.

Assignment.—T. S. Palmer.

Proposed expenditures, 1915–16.—$10,000 ($5,000 carried over from 1915).

[Research.]

Publication of Information Concerning Game Laws:

Object.—Compilation, publication, and distribution of information concerning game, game laws, interstate commerce in game, and importation of foreign birds.

Procedure.—Copies of all State and Federal game laws enacted and all bills introduced affecting game matters in general are secured, and court decisions bearing upon game legislation are compiled. In addition, periodical and other publications are searched for data on game and game laws.

Cooperation.—State officials and organizations and individuals concerned with the protection and conservation of wild life.

Publication of Information Concerning Game Laws—Continued.

Location.—Washington, D. C.

Date begun.—1900.

Results.—Index to all game legislation in the United States has been completed down to January 1, 1915; an annual bulletin and posters are issued concerning game laws; also directories of game officials and societies for the protection of birds; and four sets of ready-reference card maps have been published, containing matters of special interest to State game departments and others interested in game conservation.

Assignment.—T. S. Palmer.

Proposed expenditures, 1915-16.—$3,300.

[Extension.]

Restocking Reservations:

Object.—To stock national game preserves and other reservations with big game and game birds adapted thereto.

Procedure.—To capture and transport elk from Jackson Hole, Wyo., and the Yellowstone Park for distribution to Federal and State reservations and municipal parks; also to secure antelope and other game mammals and birds and transport them to reservations.

Cooperation.—Department of Interior, Forest Service, State game departments, and individuals.

Location.—Various points in Colorado, Utah, South Dakota, and elsewhere.

Date begun.—1911.

Results.—One carload of elk for establishing herds in two sections of Utah; two carloads of elk for establishing herds in three sections of Colorado; and supervising a shipment of antelope from Canada, presented by the Boone and Crockett Club.

Assignment.—T. S. Palmer.

Proposed expenditures, 1915-16.—$1,100.

Total, Game Preservation, $65,900 (research, $3,800; regulation. $60,750; extension, $1,350).

ECONOMIC INVESTIGATIONS.

Supervision:

Object.—To organize, inspect, and direct the staff employed in the execution of the law providing for investigating the food habits of North American birds and mammals in relation to agriculture, horticulture, and forestry and to carry on clerical and routine work necessary to the proper conduct of this project group.

Procedure.—Inspection and supervision of all work, both in the laboratory and the field; supervision of demonstration work in the field as to methods of controlling injurious rodents, predatory animals, and other animals injurious to agriculture.

Cooperation.—Forest supervisors and experiment stations in certain cases will assist in the supervision of field parties.

Location.—Washington, D. C., and many points in the United States mentioned under "Location" in the other projects of this group.

Date begun.—1905.

Assignment.—A. K. Fisher.

Proposed expenditure, 1915-16.—$15,850 (research, $7,000; regulation, $8,850).

[Research.]

Relation of Native and Introduced Mammals to Agriculture;

Object.—To devise and demonstrate methods for controlling wild mammals destructive to agriculture, animal husbandry, range lands, and forestry; to collect information relative to the kind and amount of damage done by them; and to publish and otherwise disseminate this information.

Procedure.—Experiments in poisoning, trapping, fumigating, and otherwise destroying noxious mammals, to determine the most practical and economical methods for controlling them; and work by field parties in destroying injurious mammals on Government reserves, public range lands and Government tracts, which serve to keep up infestation of private lands of agricultural districts. Demonstrations and advisory assistance will be given to individuals and organizations in the repression of mammal

Relation of Native and Introduced Mammals to Agriculture—Continued.

pests on private lands. The general lines of work mentioned above will be continued.

Cooperation.—Both the Indian Service and the Reclamation Service cooperate in controlling destructive animals on lands under their control. The North Dakota Agricultural Experiment Station cooperates in a Statewide demonstration of methods to control rodent pests and contributes $3,500 to this work. The State Board of Health of Oregon cooperates in an effort to eradicate rabies which prevails among coyotes. Cooperation with officials of the Fort Sill Military Reserve, Okla., during the spring of 1915 resulted in practically eradicating prairie dogs on about 3,000 acres of badly infested reserve lands. Cooperation has also been in effect with county supervisors in various counties in California, Idaho, and Oregon and with private stockmen in California and Wyoming in the work of destroying various rodent pests.

Location—Work is being prosecuted on five national forests in Colorado, on the Wichita Forest in Oklahoma, on the Alamo in New Mexico, and on the Coconino and Sitgreaves in Arizona. Plans for the fiscal year 1916 include work in the eradication of prairie dogs and pocket gophers on 14 additional national forests. Work on other Government lands, including experiments and demonstrations, is in progress or has been completed in many localities in California, Oregon, Washington, North Dakota, Montana, Idaho, Utah, Nevada, Wyoming, Colorado, South Dakota, Oklahoma, and Texas.

Date begun.—1905.

Results.—Notable improvements have been made in reducing cost and increasing efficiency of methods for controlling mammal pests, resulting in increased interest in cooperation by landowners. Demonstrations in western Texas were followed by the successful poisoning by ranchmen of prairie dogs on extensive tracts. An average of over 90 per cent of the prairie dogs were poisoned on 368,762 acres of infested grazing lands on six national forests at an average cost of 5½ cents per acre. This result in 10 to 50 per cent improvement in the forage conditions. Progress was made in the jack-rabbit problem in the Great Basin region and Texas. Pocket gophers were practically eradicated on 1,600 acres of the best grazing areas on the Ochoco Forest, Oregon, at a cost of 20 cents per acre. Work in the control of predatory animals has yielded valuable information for use in 1915–16, during which the campaign will be continued.

Publications issued: North Dakota Experiment Station Circular 4 (cooperative with Biological Survey), "Extermination of Ground Squirrels, Gophers, and Prairie Dogs in North Dakota"; Reclamation Record, March, 1915, "The Jack-Rabbit Problem." In press: Farmers' Bulletin 670, "Field Mice as Farm and Orchard Pests." Ready for publication: "Rabbits in Relation to Trees and Farm Crops" and "Methods for Destroying Pocket Gophers." In preparation: "Directions for Poisoning and Trapping Wolves and Coyotes."

Assignment.—A. K. Fisher, S. E. Piper.

Proposed expenditures, 1915–16.—$99,330.

Relation of Native and Introduced Birds to Agriculture:

Object.—To determine what native and introduced birds are beneficial to agriculture, horticulture, and forestry and what species are injurious; to publish and otherwise disseminate this information; to make recommendations as to which birds should be protected and which discouraged; to devise and recommend methods of encouraging the beneficial species and controlling the injurious ones; and to act as an information bureau upon all points falling under this project.

Procedure.—The relations of birds to agriculture are ascertained by work along two main lines: Field observation, including the collection of stomachs of birds, and laboratory examination and tabulation of the contents of stomachs. Future work will deal with groups of birds not yet studied, with revisions of earlier investigations, and with local problems, an example of which is the relation of birds to the alfalfa weevil, on which a bulletin was published this year. Methods of attracting birds in all parts of the United States will be published. In cases of damage by birds, means of control will be sought. The damage by the

Relation of Native and Introduced Birds to Agriculture—Continued.

introduction of starling in the nothern Atlantic States will be investigated.

Cooperation.—Entomologists and botanists in the United States National Museum and in other institutions and individuals assist in identifications, and much material is contributed by individuals.

Location.—Washington, D. C., New York, Massachuetts, South Carolina, Virginia, New Jersey, Connecticut, Kentucky, North Carolina, Utah; cooperators in numerous localities.

Date begun.—1885.

Results.—General: Gathering and furnishing to the public information on the relation of birds to agriculture, far surpassing that available in any other country in the world. This is the foundation upon which has been built a system of protective legislation which is the most advanced in existence. For the fiscal year 1915: Examinations of bird stomachs by groups was completed for the mallards, wrens, thrashers, mockers, chickadees, and titmice. Examinations were brought to date in the cuckoos, crows, and jays. A study was made of ducks destructive to oysters and other shellfish in Washington State, and measures to remedy the situation were recommended. Publications issued: Department Bulletins 107, "Birds in Relation to the Alfalfa Weevil"; 171, "Food of the Robins and Bluebirds of the United States"; 280, "Food Habits of the Thrushes of the United States"; Farmers' Bulletins 609, "Bird Houses and How to Build Them"; 621, "How to Attract Birds in Northeastern United States"; and 630, "Some Common Birds Useful to the Farmer." In press: Department Bulletin 205, "Eleven Important Wild Duck Foods." In preparation: Farmers' Bulletin, "Some Common Birds of the Southeastern United States."

Assignment.—A. K. Fisher, W. L. McAtee.

Proposed expenditure, 1915–16.—$10,520.

Rearing Fur-Bearing Animals:

Object.—To determine the best methods of feeding, confining, and otherwise handling fur-bearing animals, especially foxes, minks, and martens; to determine the species most suitable for domestication; to produce improved strains by selective breeding; to investigate the effects of temperature on fur growth; and to test methods of dressing peltries and of caring for dressed furs.

Procedure.—Animals are kept in different kinds of inclosures and fed on different kinds of food. Their behavior and condition are recorded. They are mated with reference to specific characteristics. Individuals from the same source will be kept in localities having decided climatic differences. They will be transferred from one climatic condition to another at different stages of moult and kept at different degrees of temperature at the same station. Skins will be dressed by different processes and stored under different conditions. The experience of other investigations in each of these lines will be obtained.

temperature at the same station. Skins will be dressed by different processes and stored under different conditions. The experience of others in each of these lines will be obtained.

Cooperation.—Many indiviruals engaged in fur farming have sent in reports of their methods and results.

Location.—Washington, D. C.; Linden, Md.; and Prichard, Idaho.

Date begun.—1912.

Results.—Many details of value in practical fur farming have been determined by experiment with minks and martens, and a large fund of information on this subject has been gathered. A bulletin on fox farming, based mainly on investigations of commercial fox farms in eastern Canada, is ready for publication.

Assignment.—A. K. Fisher, Ned Dearborn.

Proposed expenditures, 1915–16.—$10,000.

Investigation of Disease of Wild Ducks in Salt Lake Valley, Utah:

Object.—Investigations of the great mortality among the wild ducks of Salt Lake Valley, Utah, to determine its cause and to discover means of prevention.

Procedure.—Expert assistants will observe the progress of the trouble in the field, and experiments with captive birds to determine the cause of the mortality and to discover preventive measures which may be employed to save the ducks will be conducted.

Investigation of Disease of Wild Ducks in Salt Lake Valley, Utah—Contd.

Cooperation.—The Bear River Club Co. has granted permission for the erection of a small building for laboratory purposes on the club grounds and will furnish other facilities.

Location.—Salt Lake Valley, Utah, where experimental work will be carried on at the mouths of the Bear and Weber Rivers; also at the mouth of Jordan River, at Promontory Point, and at Locomotive Springs near Kelton.

Date begun.—1914.

Results.—From work done in the fiscal year 1915 it is believed that the trouble is due to an alkaline poison in the water, since affected birds treated with fresh water recover. A preliminary report has been issued as Department Bulletin 217, "Mortality among Waterfowl around Great Salt Lake, Utah."

Probable date of completion.—1917.

Assignment.—A. K. Fisher, Alex. Wetmore.

Proposed expenditure, 1915–16.—$4,000.

[Regulation.]

Destruction of Predatory Animals in National Forests and on the Public Domain:

Object.—Systematic and economical control on the Government reserves and public domain of wolves, coyotes, and other mammals destructive to live stock; to collect information on the losses occasioned by such animals; and to discover improved methods of poisoning, of using attractive scents in trapping, and in the discovery of breeding dens.

Procedure.—The infested region is divided into about 10 districts, each under the supervision of a competent assistant. Hunters are employed in each district either on a flat salary not to exceed $75 per month or a retaining salary of about $60 per month and bounties at fixed rates for animals killed. In certain localities where predatory animals are scarce but heavy damage is inflicted by them, reliable hunters will be paid flat salaries to destroy these animals.

Cooperation.—The Indian Service will assist in this work. Forest officials will give valuable assistance by keeping in touch with the work and informing the Bureau of Biological Survey concerning conditions and the results accomplished by the hunters. Cooperation will also be carried on with national, State, and county live-stock associations.

Location.—National forests and the public domain.

Date begun.—July 1, 1915.

Assignment.—A. K. Fisher, S. E. Piper.

Proposed expenditures, 1915–16.—$125,000.

Destruction of Ground Squirrels in National Forests:

Object.—The development and application of practical methods to control ground squirrels in national forests, to prevent injury by them to range areas and invasion by them of private lands within or adjacent to the forests; and to assist in the control of bubonic plague in California.

Procedure.—Poisoning these animals in the infested areas by field parties under experienced assistants. This work will be continued.

Cooperation.—Landowners in and adjacent to the California forests have organized to treat private lands in conjunction with the work of the department.

Location.—Work has been performed in seven national forests in California; also in the Toiyabe National Forest, Nevada, and the Colorado National Forest, Colorado.

Date begun.—1909.

Results.—Operations have extended over 170,762 acres of infested lands in six national forests in California and over 2,000 acres in Colorado, more than 90 per cent of the squirrels therein being destroyed. This work is generally appreciated by neighboring landowners. It has been demonstrated that the squirrels can be practically eradicated by two treatments with poison in consecutive years and that control of these pests in the forest is entirely practicable.

Probable date of completion.—1916.

Assignment.—A. K. Fisher, S. E. Piper.

Proposed expenditures, 1915–16.—$15,000.

Control of Crawfish:

Object.—Discovery and demonstration of methods of controlling crawfish, particularly in the Houston clay lands of Mississippi and Alabama.

Procedure.—Experiments under different weather and soil conditions to test and improve methods, followed by demonstration on farms of the economy and efficiency with which crawfish can be destroyed.

Cooperation.—Several owners grant the use of land upon which experiments and demonstrations are made.

Location.—Houston clay lands of Mississippi and Alabama.

Date begun.—1912.

Results.—Discovery of methods of destroying crawfish more economical and effective than any heretofore known. This information has been published in the Department Yearbook for 1911 and knowledge of it spread by demonstration.

Probable date of completion.—1916.

Assignment.—A. K. Fisher.

Proposed expenditures, 1915–16.—$1,500.

Total, Economic Investigations, $281,200 (research, $130,850; regulation, $150,350).

[Research.]

BIOLOGICAL INVESTIGATIONS.

Supervision:

Object.—Supervision, direction, and control of field and laboratory investigations, and general correspondence.

Procedure.—General supervision of the work is maintained, lines of investigation planned, their scope outlined, and the work allotted to members of the scientific staff. Their investigations are supervised, suggestions made as the work proceeds, and efforts made to facilitate the progress of the work wherever possible.

Location.—Washington, D. C., and throughout the United States where field work is being conducted.

Date begun.—1905.

Assignment.—E. W. Nelson.

Proposed expenditures, 1915–16.—$5,152.

Biological Surveys of the States and Territories:

Object.—To determine the distribution, abundance, and habits of the birds and mammals of the States and distribution of the principal plants, in order to obtain data by which the natural life zones may be determined, and to secure information for publication which will be of use to the public in the conservation of the bird and mammal life. The life-zone work in each State serves as a unit in completing the mapping of life zones for the entire United States.

Procedure.—Skilled field naturalists traverse the State in all directions, working the mountains, valleys, and plains in sufficient detail to learn the distribution of birds, mammals, and principal plants. Specimens of each of these groups are collected from many stations at varying altitudes when necessary for identification and study. Detailed field notes of the habits of birds and mammals are made, especially in reference to their food habits, and stomachs are saved for detailed laboratory investigation. Detailed reports are required from field men at the end of the work at each temporary station covering observations on the physiography of the district, the characteristic vegetation, and the birds and mammals. This field work continues until the State is covered in sufficient detail to warrant final reports, which are prepared in Washington from a study of specimens and collation of field reports. Much information is gained also by correspondence and the study of specimens loaned by institutions and individuals. Work along the lines indicated above will be continued in the States in which surveys are now under way, as stated below. Some work has already been done in Montana, and it is proposed to resume work there and carry it on definitely during 1915–16. Some work has already been done in Florida, and it is planned to begin during the year a definite survey of that State. It is also planned to complete for publication several of the reports on this work already in progress and to begin on others.

Biological Surveys of the States and Territories—Continued.

Cooperation.—In North Dakota, the Agricultural Experiment Station, Agricultural College, State University, State Normal School, and individuals; in Oregon, the State University and the State Game and Fish Commission. In Arizona and Alabama much interest is shown in the work, and the State fish and game commissions have afforded special facilities to forward the work.

Location.—Active field work on biological surveys will be continued in various parts of North Dakota, Oregon, Arizona, and Alabama. Field work has been practically completed in Wyoming and New Mexico. Field work for the biological survey of Montana is planned for the spring of 1916 and for Florida during the winter of 1916.

Date begun.—The general project began in 1889; in North Dakota, 1912; Oregon, 1914; Wyoming, 1910; Arizona, 1909; Alabama, 1908; New Mexico, 1903.

Results.—North Dakota field work is 80 per cent completed, and a preliminary bulletin on mammals, particularly in their relations to agriculture, has been published. In Oregon, field work is 80 per cent completed. In Wyoming, field work is completed, and a report on life zones has been prepared for publication. Other reports will follow. In Arizona, field work is about 60 per cent completed. In Alabama, field work is about 90 per cent completed, and final reports for publication are in progress. In New Mexico, the field work is completed, a report on life zones has been published, and reports on mammals and birds are being prepared. The biological survey of Texas has been completed and reports published on life zones and on mammals. A report on birds is nearly completed. Colorado is completed, and reports on life zones and mammals published. Much has been done in a large number of States, and a vast amount of data in field reports, notes, and specimens has been gathered, to be used later when work is taken up there for completion.

Publications issued: North American Faunas, No. 3, "Result of a Biological Survey of the San Francisco Mountain Region and Desert of the Little Colorado in Arizona," covering reports on life zones, birds, mammals, and reptiles; No. 16, "Results of a Biological Survey of Mount Shasta, California," covering reports on life zones, birds, mammals, and plants; No. 25, "Biological Survey of Texas," including reports of life zones, reptiles, and mammals; No. 33, "A Biological Survey of Colorado," including reports on the life zones and mammals; and No. 35, "Life Zones and Crop Zones of New Mexico." Ready for publication: North American Fauna, "Life Zone Investigations in Wyoming." In preparation: North American Faunas, "Birds of Texas" (90 per cent completed), "Birds of New Mexico" (75 per cent completed), "Mammals of New Mexico" (75 per cent completed), "Life Zones of Alabama" (75 per cent completed), and "Birds of Alabama" (75 per cent completed).

Probable date of completion.—North Dakota, 1917; Oregon, 1917; Wyoming, 1916; Arizona, 1918; Alabama, 1916; and New Mexico, 1916.

Assignment.—E. W. Nelson, Vernon Bailey.

Proposed expenditures, 1915–16.—$13,354.

Investigations of Birds and Mammals of the Public Domain:

Object.—To secure and publish definite information concerning the habits and distribution of bird and mammal life of the public domain, particularly on the national forests and Federal preserves, with especial reference to the fur bearers and species classed as game. This information is desired in connection with the conservation of valuable species, particularly game birds and mammals, and for the purpose of supplying accurate information necessary in the restocking of areas in which the species have become extinct. Information is also gathered concerning the habits and distribution of noxious species for use in connection with plans for their control. The results of these field and laboratory investigations supply information which is constantly desired by institutions and individuals throughout the country, as well as by Government departments. The results of these investigations are necessary also for use in connection with other activities of the bureau.

Procedure.—Field naturalists conduct investigations throughout the United States, Alaska, and parts of Canada and Mexico, where observations are

Investigations of Birds and Mammals of the Public Domain—Continued.

recorded, specimens collected, and detailed field reports made, which form the basis for laboratory investigations and reports. Information is also gathered from individuals and institutions. Expert study is made of the specimens for the purpose of determining the number and relationship of the species of birds and mammals, in order that they may be differentiated, their ranges accurately mapped, and the information available properly allocated. Reports are prepared from time to time for publication covering the field work of this project, and also monographs of the little-known groups of mammals, in order to supply information necessary in studying the relations of the species to agriculture and their value as game animals and as fur bearers. This work will be continued during 1915–16.

Cooperation.—State game commissions, State and other universities, agricultural colleges, scientific societies, and individuals, both in the collection and contribution of information and the loan of specimens. Several men interested in large game and its conservation have made long and costly expeditions at their own expense to secure information and specimens to forward the investigations of the bureau, and in some cases money has been contributed for these purposes.

Location.—Washington, D. C., and many points throughout the United States, Canada, and Mexico.

Date begun.—1885.

Results.—The accumulation of a vast fund of information concerning the bird and mammal life of North America, particularly the species valuable for game and as fur bearers and those injurious to agriculture. The data in the files of this office resulting from this project and allied lines of work have become so extensive that the Biological Survey has now become a clearing house for information on these subjects. Letters of inquiry are constantly received from all parts of the United States, Canada, and Mexico concerning the identity of species, their habits, value, and relations to agriculture. State authorities also consult this section of the bureau for information concerning the identity of scalps submitted for bounties, in order to prevent fraud. Hundreds of maps have been prepared showing the distribution of game and other mammals in North America.

Numerous publications, especially technical monographs of mammals, have been prepared and published as a result of investigations under this project, and others are in progress. The more recently issued of these publications are: North American Faunas—No. 29, "North American Rabbits"; No. 31, "Revision of the Wood Rats"; No. 32, "A Systematic Synopsis of the Muskrats"; No. 34, "Revision of the Spiny Pocket Mice"; No. 36, "Revision of the American Harvest Mice"; and No. 37, "Revision of the American Marmots." In preparation: "Revision of the North American Moles" (in press); "The Pocket Gophers of the Genus Thomomys" (completed); "The Grizzly and Brown Bears of North America" (nearly completed); "The North American Rice Rats," and "The North American Flying Squirrels."

Assignment.—E. W. Nelson, Vernon Bailey.

Proposed expenditures, 1915–16.—$9,894.

Bird Migration:

Object.—To determine for each species of bird in the United States its breeding and wintering places and the routes by which it passes from winter to summer home and return, and to determine the extent of its wanderings out of its regular distribution and the times of its migration. This information is for use in connection with studies of the relation of birds to agriculture and for the proper administration of the Federal migratory-bird law. It is also useful in connection with the making of open and closed seasons for game birds in the States. It is proposed in 1916 to conduct special investigation into the wintering and breeding grounds of migratory water fowl, to furnish data for use in connection with the migratory-bird law.

Procedure.—Persons located in many parts of the United States interested in the study of birds and who are sufficiently acquainted with the species watch the arrival and departure of the birds during migration and note the species which breed in their neighborhood and those which winter

Bird Migration—Continued.

there, reporting their findings to the department. The reports of field men also supply much of this information. Data are also obtained from published information in scientific journals. These data are collated in card files and the results plotted on maps, which thus show at a glance the movements of the species and their summer and winter homes. During 1915–16 the gathering and collating of data from available sources will be continued and special effort made to secure information concerning migratory waterfowl for use in connection with the administration of the migratory-bird law.

Cooperation.—About 300 volunteer observers are sending in migration reports.

Location.—Washington, D. C., and hundreds of locations throughout the United States and southern Canada.

Date begun.—1885.

Results.—Migration reports have been received from more than 2,000 volunteer observers. These notes, together with those obtained from publications and the observations of field men of the bureau, are tabulated on about 1,000,000 cards. Final reports have been published on the migratory movements of 214 species, and a bulletin on 28 species has been completed for publication. Provisional maps of the breeding ranges have been completed for each species breeding in the United States and about one-third of the breeding ranges of those breeding in Canada. The winter ranges have been mapped for about 200 species and migration maps for about 25 species.

Publications issued: Biological Survey Bulletins—18, "Distribution and Migration of North American Warblers"; 26, "Distribution and Migration of North American Ducks, Geese, and Swans"; 36, "Distribution and Migration of North American Shorebirds"; and 45, "Distribution and Migration of North American Herons and Their Allies." Department Bulletins—128, "Distribution and Migration of North American Rails and Their Allies"; 185, "Bird Migration"; and 187, "Preliminary Census of Birds of the United States." Department Yearbooks—1903, "Some New Facts about the Migration of Birds"; 1910, "The Migratory Movement of Birds in Relation to the Weather"; and 1914, "Our Shorebirds and Their Future." Biological Survey Circular 84, "Distribution of American Egrets."

Assignment.—E. W. Nelson, W. W. Cooke.

Proposed expenditures, 1915-16.—$2,400.

Total, Biological Investigations, $30,800.

ENFORCEMENT OF THE MIGRATORY-BIRD LAW.

Supervision:

Object.—To supervise, direct, and control the office and field activities in connection with the administration of the migratory-bird law.

Procedure.—The activities of the field force are directed and controlled through correspondence and by administrative field trips. Correspondence is conducted with associations and individuals interested in the enforcement of the law. Cases reported are prepared for submission to the Solicitor, and office files of useful information are maintained.

Location.—Washington, D. C.

Date begun.—1913.

Assignment.—J. E. Mercer.

Proposed expenditures, 1915-16.—$5,600 (research, $225; regulation, $5,375).

[Regulation.]

Protection of Migratory Birds:

Object.—The protection of migratory waterfowl, shore birds, and insectivorous birds under the terms of the act of Congress approved March 4, 1913, and the regulations issued thereunder by the Department of Agriculture.

Procedure.—Through district inspectors the public is educated as to the objects and provisions of the law for the protection of migratory birds; violations discovered are reported to the Department of Justice for prosecution; cooperation is maintained between the bureau and the game de-

Protection of Migratory Birds—Continued.

partments of the several States in the protection of wild migratory birds; and data are secured to enable the bureau to administer the law more intelligently. The administration will be continued along the lines already begun and by a campaign of education to interest the people at large, particularly members of gun clubs and other sportsmen, by bringing them to understand the necessity for the observance of the regulations under the migratory-bird law.

Cooperation.—Game departments of the several States, game protective associations, Audubon societies, and individuals throughout the United States.

Location.—Washington, D. C., and the several States. Headquarters of inspectors are as follows: Los Angeles, Cal.; Fort Myers, Fla.; Hinsdale and Mount Pulaski, Ill.; Dubuque, Iowa; Atchison, Kans.; Russellville, Ky.; New Orleans, La.; Doniphan, Mo.; Owego and New York, N. Y.; Manteo, N. C.; Portland, Oreg.; Providence, R. I.; Summerville, S. C.; Locustville and Newport News, Va.; and Portage, Wis.

Date begun.—1913.

Results.—Organization of the United States into 13 districts under 18 district inspectors, 174 Federal wardens, and 5 protectors; effective cooperation with most of the State game departments; gratifying increase of waterfowl and increase of birds nesting within the States that have heretofore been forced north of the boundary for that purpose by spring shooting.

Assignment.—J. E. Mercer.

Proposed expenditures, 1915–16.—$43,400.

[Research.]

Investigation of Migratory Wild Fowl;

Object.—To secure information concerning the distribution and abundance of the migratory wild fowl in their breeding and wintering resorts, for the purpose of obtaining data concerning the increase or decrease of the species as a basis for changes in the regulations under the migratory-bird law. This inquiry will show the effect of the migratory bird law in the conservation of wild fowl and will give needed information concerning the locations where they congregate during the breeding and winter seasons. As a result of this work it will be possible, when advisable, to locate areas which should be set aside as preserves in order to help conserve the species. It will also be possible to facilitate measures for increasing the species by safeguarding and possibly increasing their food supply.

Procedure.—Skilled field naturalists familiar with the species will be sent to make a careful survey of the breeding and wintering resorts of the wild fowl. They will approximately determine the absolute as well as the relative numbers of the species in each locality and definitely locate the areas where the largest number of birds congregate during the different seasons. Full reports will be made with maps. Later reports will be prepared for publication covering various areas, in order that the information procured may be available for the public.

Cooperation.—State game organizations, sportsmen's clubs, and individuals.

Location.—Washington, D. C., and many scattered areas throughout the United States, Canada, and Mexico.

Date begun.—July 1, 1915.

Assignment.—E. W. Nelson.

Proposed expenditures, 1915–16.—$2,000.

Total, Enforcement of the Migratory-Bird Law, $51,000 (research, $2,225; regulation, $48,775).

DIVISION OF PUBLICATIONS.

PUBLICATION WORK OF THE DEPARTMENT OF AGRICULTURE.

Supervision:

Object.—To supervise the printing, binding, and publication work of the department, including the editing, indexing, illustrating, and distribution of the publications, and the photographic and motion-picture work.
Cooperation.—All branches of the department and the Government Printing Office.
Location.—Washington, D. C.
Date begun.—1890.
Assignment.—Jos. A. Arnold, B. D. Stallings, A. I. Mudd.
Proposed expenditures, 1915–16.—$22,390.
The division is also charged with the administration and expenditure of the general printing fund of $500,000, appropriated to the Public Printer under the sundry civil act.

Editorial Work:

Object.—To edit and prepare for printing all manuscripts approved for publication in the regular department series, revise and correct proofs of the same, and prepare forms and blanks for the job work of the department.
Location.—Washington, D. C.
Date begun.—1890.
Assignment.—B. D. Stallings.
Proposed expenditures, 1915–16.—$19,360.

Indexing:

Object.—To prepare indexes to publications and to card index, by subjects, all publications issued by the department.
Location.—Washington, D. C.
Date begun.—1905.
Assignment.—C. H. Greathouse.
Proposed expenditures, 1915–16.—$11,090.

Illustration Work:

Object.—To prepare drawings and photographs for use in illustrating the publications of the department, for official records, and for lectures; and to make lantern slides for official use and furnish them, as well as photographs, to applicants at the price authorized by law. The work includes the production of motion pictures of the department's activities for educational purposes.
Location.—Washington, D. C.
Date begun.—1894.
Assignment.—A. B. Boettcher.
Proposed expenditures, 1915–16.—$32,810.

Distribution of Documents:

Object.—To cooperate with the Government Printing Office in the distribution of department publications; to duplicate and distribute press notices, circular letters, and blank forms; and to maintain special and general lists of addresses to which department publications are mailed.
Cooperation.—Government Printing Office.
Location.—Washington, D. C.
Date begun.—1896.
Assignment.—F. J. P. Cleary.
Proposed expenditures, 1915–16.—$107,850.

Total, Publication Work of the Department of Agriculture, $193,500 (exclusive of $500,000, general printing fund).

BUREAU OF CROP ESTIMATES.

GENERAL ADMINISTRATION.

Office of Chief:

Object.—To administer and supervise the work of the bureau.

Procedure.—The work of the bureau in Washington is conducted under the direct supervision of the officials in charge. A bureau council, comprising the various supervising and administrative officials, meets monthly with the chief of bureau for reports of progress and discussion of methods, difficulties, etc., concerning the work in hand. The supervision of the field force is accomplished through correspondence and regular trips of inspection by one of the bureau officials.

Cooperation.—Various bureaus and departments.

Location.—Washington, D. C.

Date begun.—1866.

Assignment.—Leon M. Estabrook, Nat C. Murray.

Proposed expenditures, 1915–16.—$12,500.

Office of Chief Clerk:

Object.—General supervision of clerks and other employees; immediate supervision of the bureau's files, records, and general accounts; purchase, custody, and distribution of supplies and property; distribution of seeds and publications to voluntary reporters.

Location.—Washington, D. C.

Assignment.—O. N. Fansler.

Proposed expenditures, 1915–16.—$12,255.

Total, General Administration, $24,755 (service, $20,795; research, $3,960).

[Service.]

CROP REPORTING AND ESTIMATING.

Crop Areas:

Object.—To gather information and publish periodic reports relative to areas devoted to farm, truck, and fruit crops throughout the United States.

Procedure.—The bureau secures reports from its field agents, who collect data by correspondence and travel within designated territories for the entire United States; from a corps of crop specialists, who collect data on specified crops throughout the region of their growth; and from various independent lists of voluntary crop reporters distributed throughout the agricultural sections of the United States, who furnish information for their respective localities. These data are tabulated and arranged in convenient form for comparative study and analysis as the basis of the bureau's official reports. A "crop reporting board," in secret session, considers all available information and issues the reports relative to speculative crops, while the reports relating to nonspeculative crops and live stock are issued by the chief of bureau and his assistants. A summary of these reports is given to the public at an appointed hour through the medium of the press and is also telegraphed to Weather Bureau stations throughout the United States and by them given publicity through the newspapers of their localities. As soon thereafter as possible they are published in detail in the bureau's publication. "Monthly Crop Report."

Cooperation.—Various bureaus and departments and State and local organizations.

Location.—Headquarters at Washington, D. C.; a corps of 40 field agents, each assigned to a State or group of small States; cotton crop specialist at Laurel, Miss.; tobacco crop specialist at Clarksville, Tenn.; rice crop specialist at Warrenton, Va.; and voluntary reporters in each country and township.

Crop Areas—Continued.

Date begun.—1866.

Results.—Estimates of areas devoted to various farm, truck, and fruit crops in the United States are published periodically through the press and the bureau's "Monthly Crop Report."

Assignment.—Leon M. Estabrook, Nat C. Murray.

Proposed expenditures, 1915–16.—$38,784.

Crop Conditions and Forecasts:

Object.—To collect information and publish periodic reports relative to the condition of growing crops, and to forecast the probable production indicated by the condition figure.

Procedure.—Same as outlined under "Crop areas."

Cooperation.—Various bureaus and departments and State and local organizations.

Location.—Same as under "Crop areas."

Date begun.—1866.

Results.—Reports of condition of growing crops and forecasts of probable production are published periodically through the press and the bureau's "Monthly Crop Report."

Assignment.—Leon M. Estabrook, Nat C. Murray.

Proposed expenditures, 1915–16.—$52,177.

Crop Production and Stocks:

Object.—To gather information and publish periodic reports relative to yield and quality of farm crops and the stocks of grain on farms on specified dates.

Procedure.—Same as outlined under "Crop areas."

Cooperation.—Various bureaus and departments and State and local organizations.

Location.—Same as under "Crop areas."

Date begun.—1866.

Results.—Estimates and reports of yields and quality of crops produced and of stocks of grain on farms are published periodically through the press and the bureau's "Monthly Crop Report."

Assignment.—Leon M. Estabrook, Nat C. Murray.

Proposed expenditures, 1915–16.—$38,784.

Farm Prices and Values:

Object.—To collect, compile, and publish periodically information relative to prices received by farmers for their products, prices paid for principal articles purchased by them, and values of improved and unimproved lands.

Procedure.—Schedules of inquiry are submitted to special and regular voluntary correspondents located throughout the United States. Answers are tabulated and summarized by the clerical force at Washington.

Location.—Washington, D. C.

Date begun.—1907.

Results.—Monthly report of farm prices and estimates of land values are published in the "Monthly Crop Report," and reports of prices paid for articles purchased by farmers are published yearly in department publications.

Assignment.—Nat C. Murray, Edward Crane.

Proposed expenditures, 1915–16.—$23,480.

Crop Damage:

Object.—To collect data and publish reports annually relative to the factors damaging to growing crops, as the occurrence, extent, and comparative prevalence of plant and animal diseases, adverse weather conditions, insect pests, etc.

Procedure.—Schedules of inquiry are submitted to various voluntary correspondents located throughout the United States. Answers are tabulated and summarized in convenient form for publication.

Location.—Washington, D. C.

Date begun.—1909.

Results.—Reports are published in department publications.

Assignment.—S. A. Jones, Edward Crane.

Proposed expenditures, 1915–16.—$4,524.

Farm Wages:

Object.—To collect data and publish an annual compilation of the wages paid for labor in different types of farming in different localities.

Procedure.—Data are secured through inquiry of the bureau's field agents and voluntary reporters and the information tabulated and summarized in convenient form for publication.

Location.—Washington, D. C.

Date begun.—1866.

Results.—Reports are published annually in the March issue of the "Monthly Crop Report."

Assignment.—Nat C. Murray, Edward Crane.

Proposed expenditures, 1915-16.—$5,696.

Dates of Planting and Harvesting:

Object.—To collect data and publish a compilation of the average dates of planting and harvesting for each of the principal crops grown in the United States.

Procedure.—Data are collected through the bureau's field agents and numerous voluntary correspondents and the information tabulated and summarized for publication.

Cooperation.—Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1909.

Results.—Average dates of seeding and harvesting cereal crops, flax, cotton, and tobacco published in Bureau of Statistics Bulletin 85. Charts have been published in the "Monthly Crop Report" and miscellaneous manuscript reference tables are available for use. Yearly summary of average dates of seedtime and harvest of important crops appear in department publications.

Assignment.—Edward Crane.

Proposed expenditures, 1915-16.—$8,044.

Live Stock:

Object.—To collect data and publish periodic reports relative to the number, condition, value, and mortality of farm animals; and to collect and publish data relative to the production of wool and of stocks of wool held by manufacturers on specified dates.

Procedure.—Information is collected through the bureau's field agents and by means of schedules of inquiry addressed to various voluntary correspondents, including manufacturers of woolen goods, and the data tabulated and summarized for publication.

Cooperation.—Bureau of Animal Industry.

Location.—Headquarters at Washington, D. C., with a corps of 40 field agents, each assigned to a State or group of small States.

Date begun.—1867.

Results.—Periodic reports are given publicity through the medium of the press and the department publications.

Assignment.—Leon M. Estabrook, Nat C. Murray.

Proposed expenditures, 1915-16.—$40,217.

Honeybees:

Object.—To collect data and publish periodic reports relating to winter losses, number of colonies, condition of colonies and honey plants, yields of honey per colony, etc.

Procedure.—Information is collected through the bureau's field agents and special and regular voluntary correspondents and the data tabulated and summarized for publication.

Cooperation.—Bureau of Entomology.

Location.—Washington, D. C.

Date begun.—1914.

Results.—Publication of reports through department publications and the press.

Assignment.—S. A. Jones

Proposed expenditures, 1915-16.—$5,696.

Total, Crop Estimating and Reporting, $217,402.

[Research.]

CROP RECORDING AND ABSTRACTING.

United States and Foreign Crop Data:

Object.—To collect and make available for study and use in publications and correspondence data from various sources relative to acreage, yield, value, wholesale prices, etc., of agricultural products of the United States and foreign countries; prepare tables and special articles for the Department Yearbooks and Bulletins; furnish contributions for the "Monthly Crop Report"; and provide statistical information in response to special inquiries.

Procedure.—Reports are secured from various official and private sources and the data reviewed, recorded, abstracted, summarized, and interpreted by a portion of the clerical force under the direct supervision of statistical scientists. A statistical library is maintained in connection with this work.

Cooperation.—Department library; National, State, and local organizations; the International Institute of Agriculture; and other agencies.

Location.—Washington, D. C.

Date begun.—1866.

Results.—(*a*) Manuscript records of United States and foreign crops, wholesale prices, and miscellaneous crop data are available for study, comparison, and analysis; (*b*) the publication annually in the Yearbook of the department and at more frequent intervals by means of tabular statements and correspondence of preliminary and final estimates of agricultural production in the United States and foreign countries; and (*c*) numerous special tables in the monthly publication of the bureau.

Assignment.—Frank Andrews, George K. Holmes, Charles M. Daugherty.

Proposed expenditures, 1915–16.—$21,587.

International Trade in Agricultural Products:

Object.—To compile and publish a summary of imports and exports of farm and forest products for the United States and foreign countries.

Procedure.—Data from various official sources relative to imports and exports of farm and forest products for the United States and foreign countries are compiled, interpreted, and summarized for publication.

Cooperation.—Department of Commerce; Division of Publications.

Location.—Washington, D. C.

Date begun.—1863.

Results.—Tables appear in the annual Yearbook of the department.

Assignment.—Frank Andrews, Perry Elliott.

Proposed expenditures, 1915–16.—$4,132.

Chronology of Agriculture:

Object.—To compile data showing the growth of the principal agricultural industries in the United States from the earliest dates for which records are available.

Procedure.—Research in published and other sources.

Cooperation.—Office of Markets and Rural Organization.

Location.—Washington, D. C.

Date begun.—1909.

Assignment.—George K. Holmes.

Proposed expenditures, 1915–16.—No allotment; work temporarily suspended.

Geographical Phases of Farm Prices:

Object.—To investigate the variance in prices of farm products in different localities.

Procedure.—Estimates of farm prices of farm products in different localities are reviewed, recorded, abstracted, summarized, and compared.

Cooperation.—Office of Markets and Rural Organization.

Location.—Washington, D. C.

Date begun.—1912.

Probable date of completion.—December, 1915.

Assignment.—Frank Andrews, L. B. Zapoleon.

Proposed expenditures, 1915–16.—$2,066.

Fruits and Nuts of Foreign Countries:

Object.—To compile data relative to production and trade in fruits and nuts of foreign countries.

Procedure.—Data relating to the production and trade in fruits and nuts of foreign countries are collected by research and correspondence and the information abstracted, summarized, and interpreted.

Cooperation.—Office of Markets and Rural Organization and the Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1912.

Probable date of completion.—December, 1915.

Assignment.—Frank Andrews, H. D. Ruddiman.

Proposed expenditures, 1915–16.—$4,133.

Agricultural Element of Population:

Object.—To conduct an investigation relative to the proportion of the population of the various countries of the world engaged in agricultural pursuits.

Procedure.—Data relating to the portion of the population of various countries of the world engaged in agricultural pursuits are collected by research and correspondence and the information abstracted, summarized, and interpreted.

Cooperation.—Bureau of the Census, States Relations Service, Office of Farm Management, and Office of Markets and Rural Organization.

Location.—Washington, D. C.

Date begun.—1912.

Results.—Manuscript submitted for publication by the department.

Probable date of completion.—1915.

Assignment.—Frank Andrews, Eugene Merritt.

Proposed expenditures, 1915–16.—$413.

International Sugar Investigation:

Object.—To make a study and publish a report relative to the sugar production and consumption of foreign countries.

Procedure.—Data relating to sugar production and consumption of foreign countries are collected by research and correspondence and the information abstracted, summarized, and interpreted.

Cooperation.—Bureau of Plant Industry.

Location.—Washington, D. C.

Date begun.—1912.

Probable date of completion.—December, 1915.

Assignment.—Frank Andrews, Perry Elliott.

Proposed expenditures, 1915–16.—$3,179.

United States Exports and Imports of Farm and Forest Products:

Object.—To compile and publish a descriptive bulletin for popular use relating to the exports and imports of farm and forest products of the United States.

Procedure.—Data are compiled, abstracted, summarized, and interpreted.

Cooperation.—Office of Markets and Rural Organization.

Location.—Washington, D. C.

Date begun.—1915.

Results.—Manuscript ready for publication.

Probable date of Completion.—1915.

Assignment.—Frank Andrews, Perry Elliott.

Proposed expenditures, 1915–16.—$313.

Surplus and Deficiency of National Agricultural Products:

Object.—To collect and make available for study and publication information concerning the relation of production to consumption of various farm and forest products, with special reference to food products in the United States.

Procedure.—The information is obtained by research and correspondence and the data abstracted, summarized, and interpreted.

Location.—Washington, D. C.

Date begun.—May 24, 1915.

Probable date of completion.—1916.

Assignment.—George K. Holmes.

Proposed expenditures, 1915–16.—$5,500.

Total, Crop Recording and Abstracting, $41,323.

STATES RELATIONS SERVICE.

GENERAL ADMINISTRATION.

Office of Director:

Object.—General administration of affairs of the States Relations Service.
Cooperation.—Other offices of the department, other departments, and State agricultural colleges and experiment stations.
Location.—Washington, D. C.
Date begun.—July 1, 1915, under present organization; 1888, as Office of Experiment Stations.
Assignment.—A. C. True.
Proposed expenditures, 1915–16.—$7,765.

Office of Chief Clerk:

Object.—To supervise the clerical and subclerical force of bureau; handle all matters relating to appointments and leaves of absence; supervise central file room and property room, job printing, and duplicating; handle mail and review all correspondence for the director.
Cooperation.—Other offices of the department and other departments.
Location.—Washington, D. C.
Date begun.—1902; reorganized July 1, 1915.
Assignment.—Carrie E. Johnston.
Proposed expenditures, 1915–16.—$16,515.

Accounts:

Object.—The systematic administration of the fiscal affairs of the bureau.
Cooperation.—Office of Inspection, Disbursing Office, and the Treasury Department.
Location.—Washington, D. C.
Date begun.—1906; reorganized July 1, 1915.
Assignment.—F. E. Singleton.
Proposed expenditures, 1915–16.—$11,700.

Editorial Work:

Object.—To edit and prepare for printing manuscripts and proofs of articles submitted for publication by members of the service, to cooperate with the Division of Publications in maintaining mailing lists and in the distribution of publications of the service, and to have charge of lantern slides and other illustrative material.
Cooperation.—Other offices of the department and the Division of Publications.
Location.—Washington, D. C.
Date begun.—1902; reorganized July 1, 1915.
Assignment.—W. H. Beal.
Proposed expenditures, 1915–16.—$12,730.

Library:

Object.—To collect and care for the publications of agricultural experiment stations and the agricultural extension services; circulate and care for books and periodicals in the service; examine domestic and foreign literature of agricultural science with reference to matters for use in the Experiment Station Record and to assign this to the editors of that journal; and perform reference and bibliographical work for the several offices of the service.
Cooperation.—Main department library, Library of Congress, and libraries of State agricultural colleges and experiment stations.
Location.—Washington, D. C.
Date begun.—1888; reorganized July 1, 1915.
Assignment.—E. L. Ogden.
Proposed expenditures, 1915–16.—$5,760.

Total, General Administration, $54,470 (research, $7,470; extension, $45,000; regulation, $2,000).

RELATIONS WITH EXPERIMENT STATIONS.

[Regulation.]

STATE EXPERIMENT STATIONS.

State Experiment Stations:

Object.—To enforce the provisions of an act approved March 2, 1887, and acts supplementary thereto, and of an act approved March 16, 1906, creating and endowing agricultural experiment stations; to enable the Secretary of Agriculture to certify to the Treasury Department whether Federal funds may properly be advanced to the State experiment stations and to report to Congress regarding the work and expenditures of these institutions; to furnish prompt information regarding the organization, equipment, resources, and work of experiment stations and kindred institutions throughout the world to workers in similar lines in this department and the agricultural colleges, schools, and experiment stations; and to aid the State experiment stations in the effective development of their work.

Procedure.—A financial report on schedules approved by the Secretary of Agriculture is received from each station and examined and approved in this office. Written and printed reports of the work and expenditures of each station are received and examined. A personal inspection of the work, account books, and vouchers of each station is made annually. On the basis of the information gained from the aforesaid sources a report on the work and expenditures of each station is annually made to Congress and distributed in this and other countries. The plans for work under the act of Congress of March 16, 1906, are reported by each station to this office and approved here in advance of their execution. The publications of agricultural institutions throughout the world are abstracted in a journal entitled "Experiment Station Record," issued in two volumes of nine numbers each and a detailed index each year. Advice and information regarding the stations are also given, in large measure by correspondence and personal conference with station officers.

Cooperation.—The bureaus of this and other departments, the State experiment stations, and agricultural institutions in many countries.

Location.—Washington, D. C.

Date begun.—1893; reorganized July 1, 1915.

Results.—More careful and effective expenditure of funds granted to the experiment stations; department, station, college, and school workers regularly kept informed regarding the progress of agricultural research, and thus enabled to plan and execute their work more effectively and with less waste of effort and funds.

Assignment.—E. W. Allen.

Proposed expenditures, 1915–16.—$47,950.

[Research.]

INSULAR EXPERIMENT STATIONS.

Supervision:

Object.—To exercise general supervision over the work of the experiment stations in Alaska, Hawaii, Porto Rico, and Guam.

Procedure.—The plans of work and expenditures of all stations are annually reported in advance to the Washington office and approved here. The vouchers recording their expenditures are examined and approved here. Their annual reports and bulletins are submitted to this office for review and approval before publication. By correspondence and occasional personal inspection, close touch with the progress of the stations is maintained.

Cooperation.—The bureaus of this and other departments.

Location.—Washington, D. C.

Date begun.—1902; reorganized July 1, 1915.

Results.—The more economical and effective expenditure of station funds.

Assignment.—W. H. Evans.

Proposed expenditures, 1915–16.—$3,000.

Alaska Experiment Stations:

Object.—Development of agriculture, horticulture, and stock raising in Alaska.

Procedure.—This work is accomplished through agricultural surveys, the establishment and maintenance of experiment stations, and cooperative investigations to determine the agricultural possibilities of Alaska and to aid in the development and improve the character of the agriculture in this Territory. Information regarding the results of the investigations is disseminated by means of bulletins, reports, and correspondence, and through demonstration work.

Cooperation.—The bureaus of this and other departments, experiment stations in various States and foreign countries, individuals, etc.

Location.—Headquarters, Sitka, Alaska; branch stations at Rampart, Fairbanks, and Kodiak.

Date begun.—1898; reorganized July 1, 1915.

Results.—The investigations are showing what varieties of agricultural and horticultural plants are best adapted to different regions. Plant-breeding experiments have already developed some new and hardy varieties of cereals, berries, etc. Soil studies are showing the proper methods of handling the soil. Experiments on Kodiak Island have demonstrated methods for the renewal of plant growth after the volcanic eruption of 1912. Experiments with live stock are showing the possibility of stock raising along the coast region, depending wholly on native forage.

Assignment.—C. C. Georgeson.

Proposed expenditures, 1915–16.—$40,000.

Hawaii Experiment Station:

Object.—To investigate the underlying principles of agriculture in Hawaii and to apply this knowledge to the diversification of agriculture in those islands.

Procedure.—Experiments are conducted with tropical crops to determine their adaptability to Hawaiian conditions, including the introduction of new and promising varieties of agricultural plants, plant-breeding work, study of the peculiar soils of Hawaii to determine proper methods of management, investigations of insects and other pests looking to methods of control, work in cooperative dairying, etc. The results are given publicity in bulletins and reports, correspondence, and through demonstration work.

Cooperation.—The bureaus of this department, private individuals, and the Territorial government of Hawaii.

Location.—Headquarters, Honolulu; branch stations on other principal islands.

Date begun.—1901; reorganized July 1, 1915.

Results.—The investigations have shown the possibility of diversification of agriculture, proper methods of soil management, and fertilizers for rice and pineapples, the value of rotations and cover crops, possibilities of new agricultural industries, methods of range improvement, methods of pest control, practicability of cooperative marketing and dairying, utilization of certain by-products, etc. A considerable number of new forage plants have been introduced and widely disseminated. New agricultural and horticultural crops have been found adapted to Hawaiian conditions, and improved strains have been developed. Soil surveys have been made and demonstration work is organized on all the larger islands.

Assignment.—J. M. Westgate.

Proposed expenditures, 1915–16.—$35,000.

Porto Rico Experiment Station:

Object.—To investigate the underlying principles of agriculture in Porto Rico and to apply this knowledge to the improvement of agricultural practices in that island.

Procedure.—Same as preceding project.

Cooperation.—The bureaus of this department, the insular government of Porto Rico, individuals, and corporations.

Location.—Headquarters, Mayaguez, P. R.; cooperative work at many places on the island.

Date begun.—1901; reorganized July 1, 1915.

Results.—Better methods of handling some of the peculiar soils have been discovered, improved varieties of coffee introduced, improvements in stock

Porto Rico Experiment Station—Continued.

breeding and care brought about, the proper fertilizers for citrus orchards determined, the value of rotations and cover crops shown, beekeeping as an industry of the island established, some work on sanitary dairying begun, and many new and improved agricultural and horticultural crops introduced.

Assignment.—D. W. May.

Proposed expenditures, 1915–16.—$30,000.

Guam Experiment Station:

Object.—Determination of agricultural possibilities and improvement of agricultural practices in Guam.

Procedure.—Through a study of the agricultural and allied industries of Guam and the introduction and trial of crops and animals from other countries, the station is making an attempt to restore and improve the agriculture of the island. The results of the investigations are given in publications and are shown in demonstration experiments.

Cooperation.—The bureaus of this department and the Guam government.

Location.—Island of Guam

Date begun.—1908; reorganized July 1, 1915.

Results.—Through the introduction and establishment of various forage plants permanent supplies of forage are made possible and the improvement of the live stock of the island has been begun. Improved breeds of horses, cattle, goats, swine, and poultry have been introduced, acclimated, and are being used to build up better live stock. Some of the agricultural and horticultural crops brought from other countries have proved superior to varieties now grown on the island and are well re-received by the people. Studies of animal diseases peculiar to the Tropics are in progress, with results that promise to be of value.

Assignment.—A. C. Hartenbower.

Proposed expenditures, 1915–16.—$15,000.

Total, Insular Experiment Stations, $123,000.

Total, Relations with Experiment Stations, $170,950 (research, $123,000; regulation, $47,950).

[Extension.]

FARMERS' COOPERATIVE DEMONSTRATIONS, SOUTHERN STATES.

Supervision:

Object.—To carry on supervisory, clerical, and routine work necessary to properly conduct the demonstration work in the Southern States.

Cooperation.—Other bureaus of the department, State agricultural colleges, counties, and county organizations.

Location.—Washington, D. C.

Date begun.—1904; reorganized July 1, 1915.

Assignment.—Bradford Knapp, J. A. Evans.

Proposed expenditures, 1915–16.—$87,640.

Relations with Extension Divisions of Agricultural Colleges in Southern States:

Object.—To enforce the provisions of the act of Congress of May 8, 1914, providing for cooperative agricultural extension work, to enable the Secretary of Agriculture to certify to the Treasury Department whether Federal funds may properly be advanced to the State agricultural colleges, and to report to Congress regarding the work and expenditures of the extension divisions of these institutions.

Procedure.—A financial report on schedules approved by the Secretary of Agriculture is received from each extension division and examined and approved in this office. Written and printed reports of the work and expenditures of each extension division are received and examined. A personal inspection of the work, account books, and vouchers of each division is made annually. On the basis of the information gained from the aforesaid sources a report on the work and expenditures of each extension division is annually made to Congress and distributed in this and other countries. The plans for work under the act of May 8, 1914,

Relations with Extension Divisions of Agricultural Colleges in Southern States—Continued.

are reported by each extension division to this office and approved here in advance of their execution.

Cooperation.—State agricultural colleges in 15 Southern States.

Location.—Washington, D. C.

Date begun.—1914; reorganized July 1, 1915.

Results.—More careful and effective expenditure of funds granted to the extension divisions.

Assignment.—Bradford Knapp.

Proposed expenditures, 1915–16.—The work on this project will be done in connection with the project "Supervision," and it is impracticable at this time to make definite assignments and allotments of funds.

County Agent and Boys' Club Work.

Object.—To disseminate information and conduct extension and demonstration work on all subjects relating to agriculture and rural life generally through county agents; also to give instruction to boys through the organization and work of boys' clubs. In this work is included the teaching and demonstration of methods of meeting the ravages of the cotton boll weevil in all cotton territory.

Procedure.—In each State there is a State agent, or leader, district agents and county agents; also specialists. In all but one State these are in cooperation with the State college of agriculture, where a joint director is in general charge. The county agents, with the assistance of specialists, act under the general guidance of State and district agents and carry on a large number of demonstrations conducted by farmers on their own farms. They also give miscellaneous information to farmers on all agricultural subjects upon applicaton, conduct meetings and field schools, and organize institutes and other meetings for the extension forces. They also organize communities of farmers for the purpose of instruction and demonstration, and endeavor in every way to build up an organized system of education outside the schools, which coordinates and renders available to the farmers the field activities of every institution and activity in county and State which may be of service in the improvement of rural conditions in the county. The county agents also organize, in cooperation with the schools, boys' agricultural clubs for various purposes and cooperate with specialists and others in their instruction.

Cooperation.—State agricultural colleges, other State institutions, counties, and county organizations.

Location.—Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

Date begun.—1904; reorganized July 1, 1915.

Results.—During the season of 1915, 98,542 adult farmers carried out definite demonstration work on their own farms under the supervision of the agents engaged in demonstration work during the season of 1914. Information, advice, and assistance were given to approximately ten times this number through field meetings, farmers' meetings, circular letters, and in other ways. Each farm demonstration serves as an object lesson for the community in which it is located and influences a considerable number of other farmers. Demonstrations embraced all farm crops and included approximately 165,688 acres in corn, 164,000 acres in cotton, 243,364 acres in oats, 390,000 acres in bur and crimson clovers, and 257,000 acres in other legumes; 28,790 acres were put in permanent pastures, 52,000 acres of land limed under the direction of the agents, and 46,000 definite rotation plans adopted at the agents' suggestions. Among many miscellaneous results accomplished during the year may be mentioned the removal of stumps from 22,800 acres of land, the inoculation of 141,000 hogs, the construction of 1,941 dipping vats, and the erection of 3,411 silos: 212,359 acres of land were drained and terraced in accordance with plans furnished, and approximately 250,000 tons of fertilizers were bought and mixed by the farmers, resulting in a great saving to them and the securing of a higher grade of fertilizers particularly adapted to the desired uses. The general results of demonstration work have been the widespread adoption of better methods, particularly in the preparation of the land, in the selection of seed, and in the cultivation

County Agent and Boys' Club Work—Continued.

of crops. Great interest in live-stock production has been aroused, and approximately 25,000 hogs, 8,000 cattle, and more than 4,000 horses (pure bred and grades) have been brought into the territory for breeding purposes. More than 10,000 field and farmers' meetings have been held, with an estimated attendance of 750,000. Approximately 250,000 individual visits to farmers were made during the year. In carrying on the work it is estimated that the agents traveled 2,500,000 miles, wrote 400,000 letters, and distributed 250,000 circulars and bulletins. Tabulated reports of yields on demonstration farms show an average increase of from 50 to 100 per cent over yields on similar lands where demonstration methods were not used. Detailed results of the work in each State are given in the reports of State agents on file with the department. In some instances these reports are published by the colleges as extension circulars.

Assignment.—Bradford Knapp, J. A. Evans, O. B. Martin, W. B. Mercier, H. E. Savely, J. M. Jones.

Proposed expenditures, 1915-16.—$532,000.

Home Demonstration Work, Including Girls' Club Work:

Object.—To organize and conduct extension work for women and girls by employing and directing the work of women county agents, for the purpose of disseminating information and conducting demonstrations in the homes in the rural sections of the South and instructing girls in home economics and kindred subjects.

Procedure.—In cooperation with the various institutions in the South, women county agents are employed, part of whose salaries are paid by the counties and part from funds of the colleges and the department. They conduct demonstrations in home gardens and poultry, organize women's clubs for demonstration and study, and give general instruction in home economics. They also organize girls' clubs in the teaching of gardening and canning and other subjects, and carry on the general work of extension in home economics.

Cooperation.—State agricultural colleges, women's colleges, and local organizations.

Location.—Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

Date begun.—1911; reorganized July 1, 1915.

Results.—The girls' demonstration work began with the canning clubs in 1910, when four counties in two States were organized. In 1915 an enrollment of 50,000 girls is expected, under the supervision of about 400 women agents in the 15 Southern States. The enrollment for 1914 was 33,173. Of these club members 7,793 put up 6,091,237 pounds of tomatoes and other vegetables from their tenth-acre gardens—1,918,024 cans, jars, and other containers. They are estimated to be worth $284,880.81, and nearly $200,000 of this is profit. The average profit per member was $23.30. Special work has been done with peaches, berries, figs, scuppernongs, May haws, ajeritas, oranges, kumquats, and many other fruits of the South. Nearly 3,000 girls now belong to poultry clubs, and several hundred have been doing fine work in bread clubs. Many of the best trained club members are succeeding now with their winter gardens. Club members have made uniform caps, aprons, and dresses, and thus have had good sewing lessons. In all of these activities the women on the farms have given active help. Fiscal officers, school officers, and teachers have cooperated in many ways. Thousands of mothers and adult women generally have enrolled in the home demonstration work this year. Most of them started the work by using a homemade fireless cooker and utilizing with it some poultry products which they had grown and the canned products put up by the girls in preparing nutritious and wholesome food. In quite a number of places the county agents have shown these home demonstrators how to grade eggs, and egg-selling associations have been formed, resulting in better prices and also in a demand for better breeds of chickens. Demonstrations are being made and instructions given in bread making and butter making, in which both the girls and the women take part. These lines of work call for better home conveniences and better sanitation. Numerous homemade devices are being made and shown by these demonstrators. Some of these are iceless refrigerators,

Home Demonstration Work, Including Girls' Club Work—Continued.
flytraps, ironing boards, wheel trays, bread mixers, and butter molds. The county agents are using the different steps to lead directly to the screening of doors and windows, the installing of water works, and the beautification of the homes.

Assignment.—O. B. Martin, Mary E. Creswell, Ola Powell.

Proposed expenditures, 1915–16.—$77,500.

Total, Farmers' Cooperative Demonstrations, Southern States, $697,140.

[Extension.]

FARMERS' COOPERATIVE DEMONSTRATIONS, NORTHERN AND WESTERN STATES.

SUPERVISION.

Supervision:

Object.—To carry on supervisory, clerical, and routine work necessary to properly conduct the demonstration work in the Northern and Western States.

Cooperation.—Other bureaus of the department.

Location.—Washington, D. C.

Date begun.—1912; reorganized July 1. 1915.

Assignment.—C. B. Smith.

Proposed expenditures, 1915–16.—$34,824.

RELATIONS WITH EXTENSION DIVISIONS OF AGRICULTURAL COLLEGES IN NORTHERN AND WESTERN STATES.

Relations with Extension Divisions of Agricultural Colleges in Northern and Western States:

Object.—To enforce the provisions of the act of Congress of May 8, 1914, providing for cooperative agricultural extension work, and to enable the Secretary of Agriculture to certify to the Treasury Department whether Federal funds may properly be advanced to the State agricultural colleges, and to report to Congress regarding the work and expenditures of the extension divisions of these institutions.

Procedure.—A financial report on schedules approved by the Secretary of Agriculture is received from each extension division and examined and approved in this office. Written and printed reports of the work and expenditures of each extension division are received and examined. A personal inspection of the work, account books, and vouchers of each division is made annually. On the basis of information gained from the aforesaid sources a report on the work and expenditures of each extension division is annually made to Congress and distributed in this and other countries. The plans for work under the act of May 8, 1914, are reported by each extension division to this office and approved here in advance of their execution.

Cooperation.—State agricultural colleges in 33 Northern and Western States.

Location.—Washington, D. C.

Date begun.—1914; reorganized July 1. 1915.

Results.—More careful and effective expenditure of funds granted to the extension divisions.

Assignment.—C. B. Smith.

Proposed expenditures, 1915–16.—The work on this project will be done in connection with the project "Supervision," and it is impracticable at this time to make definite assignments and allotments of funds.

COUNTY-AGENT WORK.

Demonstrations in the Eastern States:

Object.—To give instruction and demonstrations in agriculture, by means of county agricultural agents, in order to secure the adoption of better farm practice, organization, and administration, to the end of increasing the profits of farming and in improving rural social life.

Procedure.—A cooperative agreement is made with each State agricultural college to select a State leader of county agents, to be the joint representative of the college and the department. Subject to the approval of the college and the department, the State leader enters into agreements

Demonstrations in the Eastern States—Continued.

with boards of county commissioners and local associations to finance and otherwise support the work of a county agricultural agent and to select a suitable agent or agriculturist, who works thereafter under the direct supervision of the State leader. The county agents, who are men well trained in the science of agriculture and familiar with farm practice, are located permanently in counties (with or without assistants) as rapidly as circumstances warrant and funds permit. They coordinate and apply the results of the work of the several departments of the State agricultural colleges and of the United States Department of Agriculture and other research institutions, as well as the results of their own local studies of farm practice, to the end of carrying concretely to the farmers, through demonstrations on their own farms, field meetings, the local press, and otherwise, a knowledge of sound principles and successful practices in agriculture. They also aid in the reorganization and redirection of the agriculture of the counties in which they work, their aim being the correlation and federation of all economic and social forces working for the improvement of agriculture and country life. As occasion offers or need arises, they cooperate with or organize agricultural societies, clubs, and other associations whose objects are the improvement of agricultural practices, marketing and purchasing methods and facilities, and educational, home, and social conditions throughout the counties in which they work. Farmers and members of their families are met individually for consultation and in groups for purposes of study, instruction, and demonstration in school, creamery, barn, orchard, or field.

Cooperation.—State agricultural colleges and county organizations in Connecticut, Massachusetts, New Hampshire, Rhode Island, Vermont, Delaware, New Jersey, New York, Ohio, and Pennsylvania.

Location.—States named under "Cooperation."

Date begun.—1912; reorganized July 1, 1915.

Results.—Among the results during the past year are the following: 17,614 farms were visited; 3,059 meetings, attended by 200,467, were addressed; 114 adult associations, with a membership of 3,907, were organized; 124 boys' and girls' clubs, with a membership of 4,439, were organized; 2,497 farmers conducted demonstrations; 16,337 farmers and their families attended short extension courses or schools; 155 farm buildings were planned or improved; 56 silos constructed; 28 water-supply systems introduced; 27 home grounds planned or improved; and sanitary conditions bettered on 22 farms. Farm plans were outlined, wholly or in part, in 416 cases, as well as 161 drainage systems. The yield per acre of various crops, such as corn, potatoes, and alfalfa, was greatly increased; 368 registered or other live stock were purchased on suggestion of agents; 34,137 cows were tested for milk production and 185 animals for tuberculosis; 1,726 tons of commercial fertilizer were used through the efforts of agents and 3,769 tons of fertilizer were mixed at home. In addition, 29,572 tons of lime were used and 23 local sources of lime were developed; 71 purchasing and marketing associations were organized; 270,213 copies of national, State, and local publications were distributed and 63,043 letters written.

Assignment.—L. A. Clinton.

Proposed expenditure, 1915–16.—$81,940.

Demonstrations in the Central States:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—State agricultural colleges and county organizations in Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, Missouri, North Dakota, South Dakota, and Wisconsin.

Location.—States named under "Cooperation."

Date begun.—1912; reorganized July 1, 1915.

Results.—Among the results during the past year are the following: 42,940 farms were visited; 14,092 meetings, attended by 862,935 persons, were addressed; 700 adult associations, with a membership of 35,440, were organized; 422 boys' and girls' clubs, with a membership of 9,747, were organized; 7,994 farmers conducted demonstrations; 56,000 farmers and their families attended short extension courses or schools; farm improvements

Demonstrations in the Central States—Continued.

were made in 10,390 cases; improved crops, such as cereals, potatoes, alfalfa, and orchard fruits, were grown at the suggestion of or under the direction of the extension agents on 2,811,588 acres; fertilizers were used on 170 farms; 5,653 registered or other live stock were purchased by farmers on suggestion of agents; 288,000 hogs were vaccinated for hog cholera; 110 purchasing and marketing associations and 42 farmers' exchanges were organized; and over 700,000 copies of national, State, and local publications were distributed and 190,432 letters written.

Assignment.—W. A. Lloyd.

Proposed expenditures, 1915–16.—$122,075.

Demonstrations in the Western States:

Object.—Same as preceding project.

Procedure.—Same as preceding project.

Cooperation.—State agricultural colleges and county organizations in the States of Arizona, California, Colorado, Idaho, Montana, New Mexico, Oregon, Utah, Washington, and Wyoming.

Location.—States named under "Cooperation."

Date begun.—1912; reorganized July 1, 1915.

Results.—Among the results during the past year are the following: 15,838 farms were visited; 2,623 meetings, attended by 153,028 persons, were addressed; 146 adult associations, with a membership of 6,044, were organized; 329 girls' and boys' clubs, with a membership of 4,135, were organized or supervised; farmers conducted demonstrations which were attended by 3,490 persons; 21,609 farmers and families attended short courses or schools; 154 silos were put up at the suggestion of extension agents; and information regarding water supply, lighting, and heating systems was given; partial or complete plans were furnished for the management of nearly 400 farms; cereals, potatoes, alfalfa, and orchard fruits were grown at the suggestion of or under the direction of the extension agents, with the result that the yield per acre was greatly increased; although commercial fertilizers are not used extensively in this region, agents were instrumental in having them used on 201 farms and lime introduced on 198 farms; 285 registered live stock were purchased on suggestion of agents; 3,874 hogs were vaccinated for cholera; and 51 purchasing and marketing associations and 13 anti-hog-cholera clubs were formed. Numerous national, State, and local publications were distributed and 21,481 letters written.

Assignment.—D. W. Working.

Proposed expenditures, 1915–16.—$59,904.

Total, County-Agent Work, $263,919.

BOYS' AND GIRLS' CLUB WORK.

Boys' and Girls' Club Work:

Object.—To interest boys and girls and, through them, farm men and women in farm, farm-home, and rural-community problems; to teach them better methods of farm, garden, and home practice; to bring them in touch with the work of the department and agricultural colleges and schools; and to encourage them in securing such an education as will aid in making them useful and successful workers, homemakers, and citizens.

Procedure.—The boys' and girls' club work is based upon the organization of a local group of young people who are to undertake a definite project, and this work contemplates definite enrollment of members; organizing them into a local club; furnishing them with follow-up instructions; making personal visitations upon their plats; holding field meetings for instructional purposes; keeping records of observations and crop reports; making exhibits of products; encouraging the study of improved methods of grading, crating, and marketing, and the use, through home canning, of the surplus or by-products; holding club fairs and play festivals; and giving suggestions on how this club work may be correlated and coordinated with the activities not only of the home but of the public schools The various club projects are corn, potato, home gardening and canning, mother-daughter home canning, alfalfa, poultry, market-garden, farm and

Boys' and Girls' Club Work—Continued.
home handicraft, forage, home-management, farm-management, sewing, and sugar-beet clubs. The club work is organized and supervised by State, district, and local leaders, working in cooperation with the county agricultural agents and the schools.

Cooperation.—State agricultural colleges, school officers and teachers, women's clubs, and other organizations.

Location.—Throughout the 33 Northern and Western States.

Date begun.—1912; reorganized July 1, 1915.

Results.—During the past year the total membership in the boys' and girls' clubs increased to 147,546, a gain of 75,596 members.

Assignment.—O. H. Benson.

Proposed expenditures, 1915–16.—$61,752.

FARM-MANAGEMENT DEMONSTRATIONS.

Farm-Management Demonstrations:

Object.—To demonstrate to farmers the importance of certain efficiency factors relating to the organization and administration of the farm, and to increase the efficiency of the county agricultural agent work.

Procedure.—Farm-management demonstrators are placed in each State to conduct demonstrations with groups of farmers in selected areas of the State in the following manner: (1) Analyses are made of the business of 50 to 100 farms in each area, with special reference to the labor income and the important factors governing the same. (2) Each farm operator whose business has been analyzed is encouraged to make and assisted in making such modifications in the organization of his farm business as promise to increase the efficiency of his business and the net income of the farm. (3) Arrangements are made with each cooperating farmer to keep a farm business record of his work covering each business year during which the demonstration is carried on. Farmers are assembled in small groups and instructed in methods of working out their own labor incomes and of analyzing their own business.

Cooperation.—The State agricultural colleges in 33 Northern and Western States.

Location.—Washington, D. C., and at present in 20 Northern and Western States.

Date begun.—1914; reorganized July 1, 1915.

Results.—Thus far the work has chiefly consisted of analyses of the business of individual farms in selected areas, with special reference to the labor income and the important factors governing these. During the past year analyses records have been made for 5,288 farms in 79 areas in 20 States. The summaries of 2,249 of these records have been completed and sent to the farmers as a basis for modification in the organization of their farm business.

Assignment.—L. H. Goddard.

Proposed expenditures, 1915–16.—$43,205.

Total, Farmers' Cooperative Demonstrations, Northern and Western States, $403,700.

[Research.]

FARMERS' INSTITUTES AND AGRICULTURAL SCHOOLS.

Farmers' Institutes and Movable Schools:

Object.—To study the work of farmers' institutes movable schools, and similar organizations, as carried on in this and other countries, especially with a view to devising and experimenting with modified or new methods adapted to conditions in the United States; and to provide farmers' institute and extension workers with publications especially adapted to their needs.

Procedure.—Reports of the farmers' institutes, movable schools, and similar agencies at home and abroad are collected and studied, and an annual report is made on these. A new method of conducting movable schools by utilizing local talent in their management is now being tested. Syllabi and lantern slides for lectures at farmers' meetings are being prepared and distributed. Courses of study for movable schools are being prepared.

Farmers' Institutes and Movable Schools—Continued.

Cooperation.—Other bureaus of the department, which furnish the subject matter for the syllabi and courses.

Location.—Washington, D. C.

Date begun.—1904; reorganized July 1, 1915.

Results.—The reports have been useful to the farmers' institute and extension workers throughout the country, and the syllabi and courses are in much demand for use by them, as well as by agricultural schools, etc.

Assignment.—J. M. Stedman.

Proposed expenditures, 1915–16.—$9,400.

Investigations of Agricultural Instruction in Schools:

Object.—To study the methods and subject matter of school instruction in agriculture in this and other countries, with a view to determining the needs of such instruction, in order to make it practically useful to students who are to become farmers or workers in agricultural institutions; and to furnish schools with up-to-date and properly organized subject matter and illustrative materials to supplement and reenforce textbooks and field practice.

Procedure.—Schools are visited and conferences held with school officers and teachers, professors of agricultural education, etc. Reports and catalogues and other publications of agricultural schools at home and abroad are collected and studied. Publications outlining courses of study and lessons, as well as practical exercises, are prepared; also lantern slides, charts, and other illustrative material especially adapted to school use.

Cooperation.—Department bureaus, Bureau of Education, State agricultural colleges and schools, and school officers.

Location.—Washington, D. C.

Date begun.—1904; reorganized July 1, 1915.

Results.—Systematic attention is being given to problems of agricultural education from a more practical standpoint by many schools. Interest in the study of the practical problems of agricultural instruction has been greatly promoted, and the development of agricultural schools with practical aim and instruction has been materially aided.

Assignment.—C. H. Lane.

Proposed expenditures, 1915–16.—$16,200.

Total, Farmers' Institutes and Agricultural Schools, $25,600.

[Research.]

HOME-ECONOMICS INVESTIGATIONS.

Respiration Calorimeter Investigations:

Object.—To study agricultural products with reference to their use in the home for food, clothing, and equipment, and the household tasks which their use involves.

Procedure.—The systematic study by special calorimetric methods of food and equipment in relation to work.

Cooperation.—Other bureaus of the department.

Location.—Washington, D. C.

Date begun.—1894; reorganized July 1, 1915.

Results.—The work provides more definite knowledge regarding the matter studied than has hitherto been available for the use of teachers, extension workers, students, and housekeepers. Manuscripts have been prepared during the past year and will be published under the following titles: "An Improved Respiration Calorimeter for Use in Experiments with Man," "A Respiration Calorimeter for the Study of Problems of Vegetable Physiology," "Respiration Calorimeter Experiments with Man, on the Relation of Food to Energy Metabolism in the Human Body," and "Results of Respiration Calorimeter Experiments on the Ripening of Bananas and Pineapples."

Assignment.—C. F. Langworthy, R. D. Milner.

Proposed expenditures, 1915–16.—$9,100.

Studies of Food, Dietetics, Clothing, and Household Equipment, Work, and Management:

Object.—To study the nature of agricultural products used in the home for food, clothing, and equipment; to study household processes, methods, and uses pertaining thereto; to classify, compare, revise, and digest information useful to the housekeeper, student, and extension workers; and to make available to them the results of research.

Procedure.—The systematic study by general laboratory methods of the nature and uses of household supplies, and the dissemination of the results of researches in home economics through publications and other means.

Cooperation.—Other bureaus of the department.

Location.—Washington, D .C.

Date begun.—1894 as regards foods; 1914 as regards clothing, household equipment, and household management; reorganized July 1, 1915.

Results.—A large amount of both general and specific information has been brought together, which enables the housekeeper to understand her materials and enables her to use them to good advantage. So far the work has had to do chiefly with food materials and dietetics, with the result that the housekeeper has been provided with information as to the food requirements as affected by age, sex, and activity, and has been given dietary standards, a knowledge of the processes of cooking and preparation and their effects upon foods, the combination of foods to form rational meals, etc. A study of an emergency ration, undertaken in cooperation with the War Department, has been completed and a report prepared for publication. Experiments on the comparative digestibility of some of the common culinary fats have been made and results prepared for publication. Information has been made available through Farmers' Bulletins and other popular publications, technical bulletins, and in other ways. Such work is useful also to the teacher and student. As regards clothing and supplies, some general information has been collected and problems pertaining to spots and stains and their removal solved.

Assignment.—C. F. Langworthy, R. D. Milner.

Proposed expenditures, 1915–16.—$20,880.

Total, Home Economics Investigations, $29,980.

OFFICE OF PUBLIC ROADS AND RURAL ENGINEERING.

GENERAL ADMINISTRATION.

General Administration:

Object.—To administer the investigational activities of the office; to carry on its business affairs, correspondence, accounting, etc.

Location.—Washington, D. C.

Date begun.—1893.

Assignment.—L. W. Page, P. St. J. Wilson, W. C. Wyatt.

Proposed expenditures, 1915 16.—$15,389 (research, $9,789; extension, $5,600).

ROAD-MANAGEMENT INVESTIGATIONS.

Supervision:

Object.—To direct and supervise the various research and extension activities under this group and conduct routine office business, including correspondence, maintenance of records, purchase of supplies and equipment, and other clerical work.

Location.—Washington, D. C.

Date begun.—1905.

Assignment.—J. E. Pennybacker.

Proposed expenditures, 1915–16.—$6,744 (research, $5,004; extension, $1,740).

[Research.]

Collection of Data on Road Mileage, Revenues, and Expenditures, 1914:

Object.—To collect detailed information showing mileage of unimproved roads and of improved roads of each type in each county in the United States, the amount and character of bonded indebtedness for road purposes, and the expenditures and rates of taxation for road purposes in each county in the United States. Information of this character was compiled for the year 1904 and again for the year 1909. This investigation for 1914 is in line with the policy of collecting the information at five-year intervals. It may be termed an inventory of the public-road systems of the United States.

Procedure.—Statistical forms are sent in sufficient quantities to each State highway department or other adequately equipped State organization. From there they are sent out to the various counties and townships by a collaborator appointed to represent this office. The replies are sent in to the State highway department and checked and are then forwarded to this office for tabulation. As soon as all information has been received it will be published as a bulletin of the office, giving due credit to the highway departments for their assistance.

Cooperation.—State highway departments and other State agencies.

Location.—Washington, D. C., and State capitals.

Date begun.—1915.

Results.—Replies have been received from a few of the States.

Probable date of completion.—1916.

Assignment.—J. E. Pennybacker.

Proposed expenditures, 1915–16.—$8,350.

Collection of Current Data Relating to Highways:

Object.—To determine and systematize all available information and statistics relative to highways, including the maintenance of a current record and the compilation of road legislation. This project covers all statistical studies except the census of road mileage, revenues, and expenditures made at five-year intervals, and is to provide necessary information of a general or statistical character for the use of persons engaged in or aiding road improvement.

Collection of Current Data Relating to Highways—Continued.

Procedure.—A collaborator is employed in each State, who reports, under prescribed headings, at the beginning of each month. The information thus obtained is assembled in a State index, which is kept up to date. In addition, special inquiries are sent from time to time to State highway departments and other sources of information, the compilation of road laws is conducted, and all technical and trade publications bearing upon road improvement are freely consulted. Publications are issued from time to time containing data thus obtained.

Cooperation.—State highway departments and various other sources of information.

Location.—Washington, D. C.

Date begun.—1905.

Results.—Publications have been issued from time to time. The material assembled has been used in a reference way for lectures and the preparation of publications and is constantly used in answering inquiries by correspondence.

Assignment.—A. P. Anderson.

Proposed expenditures, 1915–16.—$7,995.

Utilization of Convict Labor in Road Management:

Object.—To study the management, operation, discipline, and results obtained in convict road camps throughout the United States, in order that a report may be issued by this office which will be helpful to the States and counties in the management of convict road camps, in determining the character of structures necessary and the proper method of erecting same, in the selection and use of equipment, and in the handling of the various questions of sanitation, diet, and clothing, so as to secure the best results commensurate with the welfare of the convicts.

Procedure.—Representatives of the Office of Public Roads and Rural Engineering and the United States Public Health Service have visited convict camps in all parts of the United States and made exhaustive studies. This work has been facilitated by letters to governors of States, State highway commissioners, prison superintendents, and others. The data obtained from these studies are now being prepared for publication.

Cooperation.—United States Public Health Service, in making detailed studies of health, dietary, and sanitary conditions in the various camps and in preparing such data for publication; Office of Home Economics, States Relations Service, in connection with studies on diet and clothing; State highway departments, prison officials, and others.

Location.—New York, New Jersey, Michigan, Colorado, Wyoming, Utah, Oregon, Washington, Arizona, New Mexico, Texas, Alabama, Georgia, Florida, South Carolina, North Carolina, and Virginia.

Date begun.—1914.

Results.—Data will be assembled and published.

Probable date of completion.—1915.

Assignment.—J. E. Pennybacker.

Proposed expenditures, 1915–16.—$200.

Observation of Experimental Convict Camp in Connection with Road Management:

Object.—To ascertain, by observation of a camp constructed and operated as an experimental camp, the most practicable structures, equipment, sanitation, clothing, diet, organization, discipline, and methods of management to be used in connection with the use of convicts for road construction. This project follows in logical sequence the convict-labor studies made in various parts of the United States during the fiscal year 1915.

Procedure.—A camp will be selected in a county which will conform to the plan and suggestions formulated by the Office of Public Roads and Rural Engineering and the United States Public Health Service. Representatives of the office will make careful observations of the results obtained in the management of the camp, the cost of operation, the effects upon the prisoners, and the economic results to the county, and will embody the results of their observations in a report or bulletin to be published as a Government document.

Cooperation.—United States Public Health Service; county authorities; also informal cooperation with the Office of Home Economics, States Relations Service, in matters relating to diet and clothing.

Observation of Experimental Convict Camp in Connection with Road Management—Continued.

Location.—A county in Georgia (not yet definitely selected).

Date begun.—July 1, 1915.

Probable date of completion.—June 30, 1916.

Assignment.—J. E. Pennybacker.

Proposed expenditures, 1915–16.—$2,500.

Economic Study of Highway Systems in Selected Counties:

Object.—To ascertain the economic and social effects of road improvement on the welfare and progress of rural communities.

Procedure.—In 1909 it was determined to select a limited number of counties and make comparative studies each year for approximately five years, noting the cost and the effect of road improvement from its inception through the five-year period. For this purpose counties were selected which had no improved roads. Studies were made by personal visits in eight counties for successive years, beginning in 1910 in some cases and in 1911 in others and continuing until 1914, inclusive. The comparative data thus obtained are now in course of preparation for publication as a bulletin.

Cooperation.—Local officials.

Location.—Spotsylvania, Dinwiddie, Wise, and Lee Counties, Va.; Franklin County, N. Y.; Lauderdale County, Miss.; Dallas County, Ala.; Manatee County, Fla.

Date begun.—1910.

Results.—The studies have all been completed, photographs taken, and the manuscripts are now held until 1915 land assessments in Virginia are available. It is expected that the bulletin will be prepared for publication in July, 1915.

Probable date of completion.—August 1, 1915.

Assignment.—J. E. Pennybacker, M. O. Eldridge.

Proposed expenditures, 1915–16.—$550.

Economic Study of Selected Post Roads:

Object.—To comply with a provision in the Post Office Department appropriation act of August 24, 1912, requiring the gathering of information of an economic character on post roads improved with the aid of a Federal appropriation of $500,000. The project involves studies of the character and amount of traffic, cost of hauling, financial outlay, benefits to the community, and saving to the Government in the operation of rural delivery and parcel post.

Procedure.—Engineers are assigned to visit the post roads and make thorough studies before improvement is begun and after the roads are completed. The information thus obtained will be embodied in a report to be submitted to Congress.

Cooperation.—Post Office Department.

Location.—Lauderdale County, Ala.; Boone, Story, and Dubuque Counties, Iowa; Montgomery and Bath Counties, Ky.; Cumberland and Sagadahoc Counties, Me.; Montgomery County, Md.; Leflore and Carroll Counties, Miss.; McDowell, Forsyth, Davie, and Iredell Counties, N. C.; Muskingum and Licking Counties, Ohio; Jackson County, Oreg.; Aiken County, S. C.; Montgomery and Loudon Counties, Tenn.; Travis, Hays, Comal, Bexar, and Guadalupe Counties, Tex.; Spotsylvania, Caroline, Hanover, and Fairfax Counties, Va.

Date begun.—1913.

Results.—First studies have been completed on all post roads and second studies made on three. Final studies will be made as rapidly as practicable.

Probable date of completion.—January 1, 1916.

Assignment.—J. E. Pennybacker.

Proposed expenditures, 1915–16.—$2,000.

Economic Studies of County and Township Highway Systems:

Object.—To ascertain by personal studies the organization, procedure, cost of operation, and results obtained in counties and townships in various parts of the United States; to find out the types of road, character of materials, and methods of maintenance which are yielding the best results at the least cost; to determine the elements of weakness in various local

Economic Studies of County and Township Highway Systems—Continued.
systems of management. This information is to be used as a basis for the preparation of a series of bulletins bearing upon local road construction, maintenance, and administration.

Procedure.—Approximately 100 counties have been selected, located in various parts of the United States and presenting all conditions that exist in the United States as to character of material, methods of construction, topography, character and extent of traffic, systems of organization, methods of financing construction and maintenance, etc., and each of these selected counties is made the object of a thorough study by an engineer assigned for that purpose. It is believed that these 100 counties will form an accurate index for the country as a whole. The individual reports by counties will be filed in the office and will be utilized in the preparation of bulletins.

Cooperation.—Local officials.

Location.—Approximately 100 counties, only a portion of which have been definitely selected.

Date begun.—1914.

Results.—Field studies have been completed in 28 counties.

Probable date of completion.—January 1, 1916, for field studies; July 1, 1916, for completion of bulletins and reports.

Assignment.—A. S. Brainard, R. F. Eastham, O. W. Childs, J. J. Tobin, George D. Marshall.

Proposed expenditures, 1915–16.—$5,200.

Economic Studies of State Highway Departments:

Object.—To ascertain the character of organization, working plan, cost of operation, systems of report and record, character of work done, and relative results accomplished by the various State highway departments in the construction and maintenance of roads and bridges. This information will be useful to each State in the efficient and economical handling of its State road work.

Procedure.—An engineer has been assigned to personally visit each State highway department, confer with officials, examine records, inspect work under way, prepare notes, and obtain all necessary records, forms, and data for the preparation of a report. As soon as all studies have been completed one or more bulletins will be prepared for publication.

Cooperation.—State highway departments.

Location.—All States having highway departments.

Date begun.—1914.

Results.—Studies have been completed in 11 States.

Probable date of completion.—January 1, 1916.

Assignment.—E. H. Barber.

Proposed expenditures, 1915–16.—$1,800.

Traffic Census:

Object.—To determine the wear and service of highways and cost of maintenance of various road surfaces under known traffic, with a view to determining the kind and type of road to construct to meet traffic conditions.

Procedure.—Traffic takers are employed and a census of traffic is begun on experimental roads for a 24-hour period every thirteenth day. On post roads the traffic census is taken for a period of one week at three-month intervals, except that a special traffic census is taken for two weeks at crop-moving periods.

Location.—Montgomery County, Md.; McDowell, Forsyth, Davie, and Iredell Counties, N. C.; Muskingum and Licking Counties, Ohio; Aiken County, S. C.; Montgomery and Loudon Counties, Tenn.; Lauderdale County, Ala.; Jackson County, Oreg.; Travis, Hays, Comal, Bexar, and Guadalupe Counties, Tex.; Alexandria, Fairfax, Spotsylvania, Caroline, and Hanover Counties, Va.; Boone, Story, and Dubuque Counties, Iowa; Montgomery and Bath Counties, Ky.; Cumberland and Sagadahoc Counties, Me.; and Leflore and Carroll Counties, Miss.

Date begun.—1912.

Results.—On the post roads: A year's traffic census, consisting of four regular censuses and one special crop-moving census, has been completed in Alabama, Iowa, Maine, Mississippi, Kentucky, Ohio, Oregon, and Tennessee; four regular censuses taken in Maryland, three regular cen-

Traffic Census—Continued.

suses and one special census in Virginia, three regular censuses in North Carolina and South Carolina, and two regular censuses and one crop-moving census in Texas. On the post road in Dubuque County, Iowa, only a two-weeks' census has been taken.

On the experimental roads: A third year's census was completed on the Chevy Chase road in February, and a fourth year's census is in progress; a second year's census on the Rockville pike, Maryland, will be completed on July 29, 1915; a seven days' census has been taken on the Mount Vernon Avenue road in Virginia.

Assignment.—J. E. Pennybacker.

Proposed expenditures, 1915–16.—$4,300.

[Extension.]

Advice, Lectures, and Demonstration of Road and Bridge Models:

Object.—To provide expert advice on legislation, organization, and road management; and to aid in intelligent propaganda through conferences, lectures, and demonstrations.

Procedure.—Advice, lectures, and demonstrations are given upon the request of public officials and organizations. The models are sent out on condition that transportation expenses will be paid by the local organizations. Demonstrators are assigned at the expense of the office. Models are made and lanterns slides are made and colored in the office for use in this work.

Cooperation.—Organizations throughout the country, and expositions.

Location.—United States.

Date begun.—Lectures since the establishment of the office (1893); models since 1909.

Results.—Dissemination of information of great practical educational value and the stimulation of interest in practical road improvement.

Assignment.—J. E. Pennybacker.

Proposed expenditures, 1915–16.—$16,500.

Instruction of Students in Highway Engineering:

Object.—To instruct civil-engineer students in the economic and administrative phases of highway engineering, with a view to their practical training for highway work and to meet the demand for capable highway engineers.

Procedure.—Each year a class of civil-engineer students, from 6 to 10 in number, receives instruction from various members of the staff of investigators on the road-management roll, which consists chiefly in lectures and the preparation of a thesis on the subject, together with special reading along the lines of road economics.

Location.—Washington, D. C.

Date begun.—1905.

Results.—Several classes of civil-engineer students have been instructed in this office in the various lines of work, who have latter been advanced to the position of junior highway engineers and senior highway engineers, and some of whom accepted more remunerative positions as highway engineers with counties and States or have engaged in private practice.

Assignment.—J. E. Pennybacker.

Proposed expenditures, 1915–16.—Work temporarily suspended; no allotment.

Total, Road-Management Investigations, $56,139 (research, $37,899; extension, $18,240).

ROAD BUILDING AND MAINTENANCE INVESTIGATIONS.

Supervision:

Object.—To supervise the various subactivities under this group and carry on routine office business, including correspondence, maintenance of records, purchase of supplies and equipment, etc.

Location.—Washington, D. C.

Date begun.—1904.

Assignment.—P. St. J. Wilson, Vernon M. Peirce, E. W. James, T. Warren Allen.

Proposed expenditures, 1915–16.—$9,404 (research, $2,000; extension, $7,404).

[Research.]

Study of Representative State Systems of Road Maintenance:

Object.—To study details of systematic maintenance developed by State highway departments in representative States, in order to disseminate such information to road officials throughout the country.

Procedure.—Study is made of published reports and records of State organizations; conferences are had with engineers of the organizations in their various districts; visits to work in progress are made, if possible, in company with local engineers, and details of practical methods are carefully studied.

Location.—In those States having State highway departments most of the work is being done at the head office of the State department, at State division offices, and on State roads. Work during the past year has been done at Boston, Worcester, Springfield, and other points in Massachusetts; at Concord and Keane, N. H.; and at Albany, Troy, Syracuse, and other points in New York.

Date begun.—1914.

Results.—Reports are in progress. Data have been collected which are of great assistance in replying to queries constantly received from county officials regarding maintenance methods and organization.

Probable date of completion.—Massachusetts, October, 1915; New Hampshire, October, 1915; New York, October, 1916.

Assignment.—E. W. James.

Proposed expenditures, 1915–16.—$950.

Study of Representative County Systems of Road Maintenance:

Object.—To study details of county road maintenance in selected counties having improved roads and to disseminate such information among other counties.

Procedure.—Counties are visited, conferences had with county engineers. and studies made on the ground of the details of maintaining improved county roads.

Location.—Studies are to be made in Hillsboro and Duval Counties, Fla.; Montgomery County, Ala.; Hines County, Miss.; and Allegheny County, Pa.

Date begun.—1914.

Results.—Positive results in counties so far studied are of little value. A lack of any system of conserving the huge investment of public funds in road construction is general. Original work must be done to devise and introduce suitable working methods and practical systems of county maintenance, more careful handling and control of annual road funds through suitable accounting methods, better supervision of work, more equitable distribution of funds, and a general revision of current methods now used in most counties.

Assignment.—E. W. James.

Proposed expenditures, 1915–16.—$950.

Investigation of Cost of Road Maintenance:

Object.—To conduct experimental maintenance to secure accurate cost data for various types of roads.

Procedure.—Under specific appropriation, this office constructs certain experimental roads. These have been built in Montgomery County, Md., and one is in course of construction in Alexandria County, Va. To determine the relative value of various types of construction, maintenance of the built roads is necessary over a period of five years or more. This maintenance is conducted by the office with funds from the specific appropriation.

Cooperation.—Road authorities in Montgomery County, Md., and Alexandria County, Va.; and the Bureau of Plant Industry.

Location.—Alexandria County, Va., Montgomery County, Md., and the Department of Agriculture grounds, Washington, D. C.

Date begun.—1907.

Results.—Accurate data have been secured covering the cost of maintenance of dirt, gravel, and bituminous macadam roads. Reports for the past year's work are to be published in the "Annual Progress Report for 1914," in a department bulletin covering the work of the year, and in technical publications.

Assignment.—E. W. James.

Proposed expenditures, 1915–16.—$2,013.

[Extension.]

Object-Lesson Roads:

Object.—To demonstrate proper methods of construction and the most efficient use of materials, instruct local road officials in the art of road building, and correlate conclusions drawn from laboratory tests with those resulting from service tests.

Procedure.—Applications are received from local road authorities for advice and assistance in the construction of roads where funds are available and everything is ready for the work to proceed. These applications are acted upon, as far as possible, in the order of their receipt by this office. A highway engineer is detailed to superintend the construction of a short section of road as an object lesson to the local authorities and remains upon the job until he has thoroughly instructed the foreman, who is then able to continue the work after the engineer has been given another assignment.

Cooperation.—State, county, and township authorities who have legal control of the roads to be improved.

Location.—Object-lesson roads have been built in a great many different localities throughout the United States, and any political unit, excepting incorporated towns and cities, which makes proper application and agrees to the department's terms, may receive this kind of assistance.

Date begun.—1904.

Results.—Information has been secured and disseminated as to the best methods of road construction through the construction of short stretches of road as object lessons, and improved methods of construction have been adopted by the various localities in which these roads have been built.

Assignment.—Vernon M. Peirce.

Proposed expenditures, 1915–16.—$24,500.

County Road Systems:

Object.—To make a study of the roads of a county or other political subdivision and prepare general plans and specifications for their administration, improvement, and maintenance.

Procedure.—Highly skilled and experienced highway engineers are sent upon requests from county officials having jurisdiction of roads to advise with them in connection with the improvement of the county system of road supervision, improvement, and maintenance. These engineers go over the situation thoroughly, taking into account all of the factors entering into the local problem and then, in the light of their wide experience, formulate a plan of action for the improvement of the roads throughout the county, considering the county as a unit.

Cooperation.—County officials in charge of roads in the various counties seeking this character of assistance. The Office of Public Roads and Rural Engineering furnishes a consulting engineer to cooperate with local officials.

Location.—Any county or political subdivision of similar size and importance which makes proper application and agrees to the department's terms of cooperation.

Date begun.—1907.

Results.—Many counties have adopted the department's recommendations, reorganized and systematized their highway improvement work, and are now working along definite lines as to the ultimate system of roads that will be built, their methods of construction, and administration.

Assignment.—Vernon M. Peirce.

Proposed expenditures, 1915–16.—$7,600.

Inspection, Advice, and Lectures:

Object.—To make inspections, study specific local road problems, prepare definite recommendations for their solution, and bring this information to the assistance of those who have asked for it.

Procedure.—Requests are frequently received at this office for assistance in the nature of advice, many of them requiring that an inspection of local conditions be made and that highway engineers be detailed to make inspections, give advice to local highway officials, and occasionally deliver lectures before gatherings of highway associations and mass meetings of citizens interested in some specific highway-improvement problem.

Inspection, Advice, and Lectures—Continued.

Cooperation.—Township and county authorities in legal control of the roads. The Office of Public Roads and Rural Engineering furnishes a consulting engineer to cooperate with the local officials.

Location.—Any political unit in the United States, except incorporated towns and cities, which makes proper application and agrees to the department's terms of cooperation.

Date begun.—1894.

Results.—Many units unable to employ skilled highway engineers have been advised how to solve their road problems.

Assignment.—Vernon M. Peirce.

Proposed expenditures, 1915–16.—$22,194.

Superintendence of County Roads:

Object.—To demonstrate to county officials the advantages accruing from the supervision of all county roads by one skilled in highway construction and maintenance and the advantages of centralized control over all roads in a county.

Procedure.—When application for assistance has been made and contract entered into with this department an engineer is assigned to take charge of the maintenance and construction of the county roads. This engineer supervises the building of roads and bridges, organizes a system for maintaining the roads, and introduces proper systems of reports and methods of accounting.

Cooperation.—County officials in legal control of the roads who have made application for assistance of this kind.

Location.—Any county which makes proper application and agrees to the department's terms of cooperation.

Date begun.—1911.

Results.—The roads in Bennington and Rutland Counties, Vt., were in charge of engineers from this office for two years and were much improved, and the county officials being convinced of the advantages of centralized control in the hands of qualified men adopted this system and elected county highway engineers.

Assignment.—Vernon M. Peirce.

Proposed expenditures, 1915–16.—$20,600.

Bridge Construction in Connection with Road Building and Maintenance:

Object.—To furnish local officials with plans and specifications for bridges and to investigate conditions and advise the authorities interested as to the best methods of bridge construction to meet their peculiar needs and conditions.

Procedure.—Standard plans and specifications of various types of structures are prepared in the office and furnished to local officials and engineers upon request. Engineers visit communities and advise the authorities interested relative to special bridge problems and prepare plans to suit local conditions. They also superintend the construction of bridges to illustrate to local officials proper methods of construction.

Cooperation.—County and township authorities in legal control of the roads. The Office of Public Roads and Rural Engineering furnishes a consulting engineer to cooperate with the local authorities.

Location.—Any county or political subdivision of similar size and importance which makes proper application and agrees to the department's terms of cooperation.

Date begun.—1909.

Results.—Highway officials in various local communities have been furnished plans and specifications and have been advised as to the best types and methods of bridge construction.

Assignment.—O. L. Grover.

Proposed expenditures, 1915–16.—$4,600.

Improvement of Roads in United States National Forests—Advice and Supervision:

Object.—To advise with the Forest Service as to the best methods of constructing and maintaining roads and to make surveys and supervise the construction of a system of roads through the various United States national forests.

Improvement of Roads in United States National Forests—Advice and Supervision—Continued.

Procedure.—Surveys and plans are made for the construction of roads in national forests and advice rendered counties interested in opening roads across national forests.

Cooperation.—Forest Service.

Location.—National forests.

Date begun.—1906.

Results.—Surveys have been started in a number of districts, and supervisors of the national forests have been advised regarding road construction and maintenance in the forests.

Assignment.—T. Warren Allen.

Proposed expenditures, 1915–16.—$12,470.

Improvement of Roads in National Parks—Advice and Supervision:

Object.—To advise with national-park officials as to the best methods of constructing and maintaining roads in the various national parks.

Procedure.—Surveys and designs are made for the opening of trails and the construction of roads in national parks, and advice is given as to the best methods of constructing and maintaining the same.

Cooperation.—Department of the Interior.

Location.—United States national parks.

Date begun.—1914.

Results.—Surveys have been made in the Yosemite Park, and work will be started in other parks as rapidly as possible.

Assignment.—T. Warren Allen.

Proposed expenditures, 1915–16.—$8,050.

Road Maintenance—Advice and Inspection:

(*a*) POST ROADS—

Object.—To supervise the maintenance of certain post-road projects for the purpose of determining accurately the relation between the cost of effective maintenance and the available local funds and of determining maintenance costs on various types of roads; and to advise local road authorities.

Procedure.—Certain post roads built with funds provided under the act of August 24, 1912, will be of concrete, bituminous gravel, and macadam construction, and are, if possible, to be maintained with local funds under the supervision of this office. This work will provide an unusual opportunity for the Government to secure accurate and detailed maintenance cost data on a large number of types of construction not otherwise available to it, and will provide information desired and more and more frequently requested by engineers and local officials in all parts of the country.

Cooperation.—Local administrative units cooperating in post-road construction.

Location.—See locations under project "Improvement of post roads."

Date begun.—1914.

Results.—The first general repair data of the Ohio post road so far completed are in hand. Work is not yet possible on other roads.

Assignment.—E. W. James.

Proposed expenditures, 1915–16.—$1,963.

(*b*) WASHINGTON-ATLANTA HIGHWAY—

Object.—To supervise the maintenance of the Washington-Atlanta Highway and thereby demonstrate maintenance methods to county officials; also to study the cost of effective maintenance in the coastal-plain region.

Procedure.—The route selected between Washington and Atlanta is divided into three sections, to each of which an engineer is assigned to supervise maintenance and repair. These men travel over their sections, giving personal directions to patrolmen and repair gangs, and act in cooperation with local officials and engineers in promoting better maintenance methods.

Cooperation.—Counties and subdivisions and the American Highway Association. The work is subject to a cooperative arrangement between the Government and the local units, as the cost of actual maintenance is met from local funds.

Road Maintenance—Advice and Inspection—Continued.

(*b*) WASHINGTON-ATLANTA HIGHWAY—Continued.

Location.—Brunswick and Mecklenburg Counties, Va.; Cumberland, Harnett, Johnston, Wake, Durham, Granville, Hoke, Moore, Montgomery, and Richmond Counties, N. C.; Chesterfield, Lexington, Aiken, and Richland Counties, S. C.; Wilkes, Warren, Taliaferro, Oglethorpe, Clarke, Greene, McDuffie, Morgan, Richmond, Walton, and Dekalb Counties, Ga.

Date begun.—1914.

Results.—A total of 681.8 miles of road in the above counties was under the supervision of this office during the year 1914. This is about 81.2 per cent of the total distance from Petersburg, Va., to Atlanta, Ga. There has been expended on maintenance alone $10,042.17 to December 31, 1914, and $36,075 has been allotted for maintenance, available up to varying dates, depending on the time when application was made. Long sections of the road were found to be in unsuitable condition for maintenance and required heavy repairs or entire construction. On this work $75,785.95 was expended under the direction of the office engineers in 1914 on 153.7 miles of road. All but one of those counties whose applications have expired to date have renewed application, in some cases with an increase of maintenance funds.

Assignment.—E. W. James.

Proposed expenditures, 1915–16.—$14,430.

(*c*) ORGANIZED MAINTENANCE OF BOND-AIDED ROADS—

Object.—To introduce organized maintenance in counties that have constructed roads through bond issues.

Procedure.—Counties make application for the services of an engineer to take personal charge of road maintenance in the counties, usually for a period of one year. This engineer, under the terms of the application, has entire authority to direct and approve expenditures of the county road funds during the year.

Cooperation.—Road authorities in Fairfax County, Va., and Leflore County, Miss.

Location.—Fairfax County, Va., and Leflore County, Miss.

Date begun.—1914.

Results.—Arrangements are now being completed with the above two counties. The preliminary work on this project is completed, and a list of counties is in hand where work may be advantageously conducted. The nature of the work, requiring as it does the assignment of an engineer for one year, limits the quantity of work possible within that time.

Assignment.—E. W. James.

Proposed expenditures, 1915–16.—$3,139.

Improvement of Post Roads:

Object.—To construct and improve highways over which United States mail is carried for service tests by the Post Office Department, pursuant to the act of August 24, 1912, and to ascertain the economic value of such improvement to the community.

Procedure.—Communications are received from States, counties, and townships advising that they would like to cooperate with the Post Office Department and the Department of Agriculture in improving certain roads and that they have available sufficient funds to pay at least two-thirds of the cost of the proposed improvement. If it appears from the request that the road is such as will probably meet the requirements of the act of Congress making available money for this work, an engineer is detailed by this office to inspect the road, make an estimate of the cost of the improvement, and secure additional data desired by the Post Office Department. This report is transmitted to the Post Office Department, which decides whether or not Government funds shall be allotted. If an allotment is made by the Post Office Department, this office then supervises the construction of the improvement.

Cooperation.—Post Office Department, States, counties, and townships.

Location.—See table below.

Date begun.—See table below.

Results.—Five projects, as shown below, have been completed, resulting in the improvement of 194.5 miles of roads.

Probable date of completion.—See table which follows.

Post roads completed and in course of construction.

Location.	Date begun.	Probable date of completion.
Lauderdale County, Ala	1913	Completed.
Boone and Story Counties, Iowa	1913	Do.
Dubuque County, Iowa	1914	Dec. 1, 1915.
Montgomery and Bath Counties, Ky	1913	Aug. 1, 1915.
Cumberland County, Me	1914	Sept. 15, 1915.
Montgomery County, Md	1914	Completed.
Leflore County, Miss	1913	Aug. 1, 1915.
McDowell County, N. C	1914	Dec. 1, 1915.
Davie, Forsyth, and Iredell Counties, N. C	1914	Aug. 1, 1915.
Muskingum and Licking Counties, Ohio	1913	Dec. 1, 1915.
Jackson County, Oreg	1913	Completed.
Aiken County, S. C	1914	Nov. 1, 1915.
Loudon County, Tenn	1914	Sept. 1, 1915.
Montgomery County, Tenn	1914	Aug. 1, 1915.
Austin-San Antonio Road, Tex	1914	Dec. 1, 1915.
Fairfax County, Va	1913	July 1, 1915.
Spotsylvania, Caroline, and Hanover Counties, Va	1913	Completed.

Assignment.—Vernon M. Peirce.
Proposed expenditures, 1915–16.—$25,595.

Instruction of Students in Highway Engineering:

Object.—To give graduate civil engineers a course in highway engineering such as will qualify them to take actual charge of highway work.

Procedure.—Civil-engineer students are given instruction by being employed with highway engineers and senior highway engineers as assistants upon object-lesson roads and in this way acquire practical experience as well as training in the theory of highway engineering.

Location.—Washington, D. C.; and on the object-lesson, experimental, and post roads in the various States.

Date begun.—1905.

Results.—Graduate students in civil engineering have been instructed in the art of road building and are now in the employ of the United States and of various States and counties.

Assignment.—Vernon M. Peirce.

Proposed expenditures, 1915–16.—Work temporarily suspended; no allotment.

Total, Road Building and Maintenance Investigations, $158,458 (research, $5,913; extension, $152,545).

ROAD-MATERIAL INVESTIGATIONS.

Supervision:

Object.—To administer the various subactivities under this group and conduct routine office work.

Location.—Washington, D. C.

Date begun.—1904.

Assignment.—Prévost Hubbard.

Proposed expenditures, 1915–16.—$10,432 (research).

[Research.]

Routine Chemical Testing and Inspection:

Object.—To conduct routine chemical tests and inspections of bituminous and nonbituminous dust preventives and road binders, with a view to determining their fitness for particular classes of work, conformity with specifications, etc. The inspection of culvert metal for use in roads built under the supervision of the office is also a part of this activity.

Procedure.—Samples are tested free of charge when submitted by State and county officials, good-roads organizations, etc. Materials for use in the general construction of experimental work of the office are also tested for their conformity to specifications, and when the quantity of material involved warrants it an inspection is made at the plant of the manufacturer.

Routine Chemical Testing and Inspection—Continued.

Location.—Washington, D. C., and occasionally at the plant where materials are manufactured.

Date begun.—1904.

Results.—During the fiscal year 1914 the chemical laboratory received for tests 327 samples, including fluxed native asphalts, petroleum and tar products, sands, culvert metals, and miscellaneous road materials. This number will evidently be exceeded during the fiscal year 1915.

Assignment.—C. S. Reeve.

Proposed expenditures, 1915–16.—$7,100.

Microscopic Examination and Classification of Road-Building Rocks:

Object.—To examine microscopically and classify road-building rocks and to study the relation existing between their physical properties and mineral composition; and to investigate the mineral composition of blast-furnace and open-hearth slags in relation to their road-building qualities.

Procedure.—All samples of rock received for physical tests are submitted to the petrographer for identification and classification, and all crystalline rocks are subjected to microscopic examination for the purpose of determining their mineral composition.

Location.—Washington, D. C.

Date begun.—1901.

Results.—The data obtained in this work are classified and studied, and the work to date has resulted in establishing some definite relations between the mineral composition and the physical properties of road-building rocks. A bulletin on the subject has been prepared during the year.

Assignment.—E. C. E. Lord.

Proposed expenditures, 1915–16.—$2,640.

Research on Dust Preventives and Road Binders:

Object.—To investigate the effect of methods of production upon the character of bituminous materials, the relative fitness of the various types of bituminous materials for different classes of construction, and the changes which take place in these materials upon exposure to service conditions; and to conduct any other laboratory investigation which has for its purpose the production of improved materials or of new data regarding materials at present in use.

Procedure.—Problems are suggested largely from observation of the behavior of materials in construction work and are carried out when the volume of regular work permits.

Location.—Washington, D. C.

Date begun.—1910.

Results.—One paper on "The Effect of Exposure on Bitumens" has been published, and the data for a second one are complete. An investigation of the relative binding value of various bitumens with different types of rock is partially completed and should yield results for publication before 1916.

Assignment.—Prévost Hubbard, B. A. Anderton.

Proposed expenditures, 1915–16.—$800.

Experimental Bituminous Road Construction and Maintenance:

Object.—To develop new types of bituminous-bound and bituminous-treated roads, and to correlate laboratory experiments with service tests.

Procedure.—Upon application for assistance in utilizing local materials with an artificial binder, a laboratory investigation of the project is made and a chemist assigned to cooperate in the construction. The regular maintenance of experiments thus far constructed also comes in part under this project.

Cooperation.—State and county authorities.

Location.—Various parts of the United States.

Date begun.—1905.

Results.—A number of experimental sections have been constructed and are now under observation in the vicinity of Washington, D. C., and throughout the United States. The experiments at Ocala, Fla., have been completed, and the Mount Vernon Avenue road, in Alexandria County, Va., now under construction, will be completed about August 1. Plans for a series of experimental sections on the Russell road, Alexandria

Experimental Bituminous Road Construction and Maintenance—Continued.
County, Va., and on the Rockville-Potomac post road, Maryland, are being prepared, looking to construction at an early date. Data are published in the annual "Progress Report of Experiments in Dust Prevention and Road Preservation" or in "Construction and Maintenance of Roads and Bridges."
Assignment.—Prévost Hubbard, C. S. Reeve.
Proposed expenditures, 1915–16.—$1,600.

Physical Tests of Road-Building Materials:
Object.—To determine, by means of physical tests, the suitability of various materials for use in road construction.
Procedure.—Samples of road materials are received and tested free of charge for any citizen of the United States and a report furnished him showing for what type of road construction the material is best suited.
Location.—Washington, D. C.
Date begun.—1893.
Results.—Several thousand samples have been received and reports submitted to State and county officials, corporations, and individual citizens in all parts of the United States.
Assignment.—F. H. Jackson.
Proposed expenditures, 1915–16.—$8,220.

Concrete Investigations:
Object.—To investigate the physical properties of concrete, including studies of the effect of flow, determination of the laws of expansion and contraction of concrete roads, factors involved in the distribution of stresses in reinforced bridge slabs, etc.
Procedure.—Tests are made on large-sized concrete specimens, such as cylinders, beams, and slabs. The loading is obtained by a specially constructed apparatus at Arlington Farm, Va.
Cooperation.—Ohio State Highway Commission.
Location.—Washington, D. C.; Arlington, Va.; Chevy Chase, Md.; and Zanesville, Ohio.
Date begun.—Prior to 1905.
Results.—The results so far obtained are only preliminary, and no final conclusions have been drawn from the tests. However, in flat slabs some peculiar results have been obtained in the way of reversal of stresses, and the effect of flow has been observed on the magnitude and distribution of stresses in concrete.
Assignment.—E. B. McCormick, E. B. Smith.
Proposed expenditures, 1915–16.—$7,020.

Nonbituminous Road-Material Investigations:
Object.—To investigate the physical properties of nonbituminous road materials, correlate the results of physical tests with behavior in actual service, and develop tests to meet new conditions in road construction.
Procedure.—Samples are obtained from various sources representing materials which have given known results in actual service. The data obtained form the basis for arriving at limiting values, used to determine the fitness of material for any given type of construction.
Cooperation.—Various State highway commissions.
Location.—Washington, D. C.
Date begun.—1893.
Results.—As a result of the data obtained, a much more intelligent interpretation of the relation between physical tests of road materials and actual service conditions has been possible.
Assignment.—Prévost Hubbard, F. H. Jackson.
Proposed expenditures, 1915–16.—$1,120.

Instrument Making and Repairing:
Object.—To build and keep in repair testing machines and instruments required in conducting road-material investigations.
Procedure.—Machines and instruments used in the testing of road materials and for other purposes in connection with other activities of the office are constructed and kept in repair.

Instrument Making and Repairing—Continued.

Location.—Washington, D. C.

Date begun.—1893.

Results.—Several instruments have been constructed from designs furnished by the office.

Assignment.—E. B. McCormick, E. C. Glascock.

Proposed expenditures, 1915–16.—$5,580.

Standardization of Methods of Testing Bituminous Road Materials:

Object.—To revise current methods of testing bituminous road materials or develop and introduce new and better methods.

Procedure.—Some of this work is undertaken as an assignment by the committee on standard tests for road materials of the American Society for Testing Materials. Proposed tests which appear in technical literature are investigated for the purpose of determining their value.

Cooperation.—American Society for Testing Materials.

Location.—Washington, D. C.

Date begun.—1905.

Results.—An investigation of a proposed method for the determination of paraffin scale has been partially completed. An investigation of a toughness test for bituminous materials has been started. The method of making the penetration test has been better established and reported upon through a section of the American Society for Testing Materials. A new method for making the melting-point determination is under investigation.

Assignment.—Prévost Hubbard, C. S. Reeve, F. P. Pritchard.

Proposed expenditures, 1915–16.—$1,200.

Standardization of Methods of Testing Nonbituminous Road Materials:

Object.—To standardize physical methods of testing nonbituminous road materials, so that the results obtained by various laboratories may be comparable.

Procedure.—Standard methods of testing are obtained by studying in detail various methods in common use for the purpose of determining the one which will give the most accurate and trustworthy results.

Cooperation.—American Society for Testing Materials and American Association of Portland Cement Manufacturers.

Location.—Washington, D. C.

Date begun.—1893.

Results.—This work has resulted in the standardization of several road-material tests by the American Society for Testing Materials.

Assignment.—Prévost Hubbard, F. H. Jackson.

Proposed expenditures, 1915–16.—$800.

[Extension.]

Instruction of Students in Highway Engineering:

Object.—To instruct civil-engineer students in the characteristics and methods of testing and using dust preventives and road binders and nonbituminous road materials.

Procedure.—Civil-engineer students are instructed in methods of testing road materials in the physical laboratory and in the chemical laboratory of this office, where they acquire a practical working knowledge of these subjects.

Location.—Washington, D. C.

Date begun.—1905.

Results.—A number of civil-engineer students have been instructed in the art of testing road materials and in the various methods employed in determining the relative value of different kinds of matrials.

Assignment.—Prévost Hubbard.

Proposed expenditures, 1915–16.—Work temporarily suspended; no allotment.

Total, Road-Material Investigations, $51,604 (research).

[Research.]

FIELD EXPERIMENTS.

Supervision:

Object.—To administer the various subactivities under this group and conduct routine office work.

Location.—Washington, D. C.

Date begun.—1911.

Assignment.—Vernon M. Peirce, E. B. McCormick.

Proposed expenditures, 1915–16.—$3,789.

Investigations of the Relative Value of Road-Building Materials and Methods of Construction:

Object.—To determine by experimentation the relative merits and values of various preparations and materials for use in road construction and of the various methods and types of road construction and maintenance.

Procedure.—A section of road is selected and certain experimental construction determined upon. Arrangements are then entered into with the local authorities looking to cooperation in the expense of construction, this office retaining the right to carry out the experiments decided upon, both in the matter of construction and of maintenance. Short sections of road are then constructed, extending over the entire portion, each section being an experiment in itself, designed to determine the relative merits of certain road materials and the best methods of using the same in road construction. Systematic inspections are made from time to time and reports prepared of the condition of the various sections.

Cooperation.—County and State officials in legal control of the roads.

Location.—Montgomery County, Md., and Alexandria County, Va.

Date begun.—1911.

Results.—Bituminous macadam, water-bound macadam (surface treated with various organic and inorganic materials), bituminous concrete, Portland cement concrete (plain and surface treated), and brick roads have been built and maintained. Complete descriptions of this work have been published in circulars from year to year. Many highway engineers have visited these roads and have received valuable information. Information as to the relative values of the various materials is being secured.

Assignment.—Vernon M. Peirce.

Proposed expenditures, 1915–16.—$46,320.

Traction Tests:

Object.—To determine the effect of width of tire, diameter of wheel, type and size of axle bearing, kind of power, and method of application of power on tractive effort required to haul vehicles over various types of road surfaces; to obtain comparative data on the resistance offered to traction by unimproved and improved road surfaces and by grades in the case of automobiles and horse-drawn vehicles; and to obtain data on the comparative pulling power and sustained effort and its relation to the rations of light and heavy draft animals.

Procedure.—Requests are being received from time to time by the office in regard to details of designs for wagons, the efficiency of improvement of road surfaces and its relation to grades, the capacity for sustained effort of draft animals, and class of work for which the different road types are best adapted.

Cooperation.—Bureau of Animal Industry.

Location.—Washington, D. C., and post and experimental roads throughout the United States.

Date begun.—1913.

Results.—Tests have been made in Iowa, Kansas, Minnesota, Alabama, Tennessee, Ohio, Maryland, District of Columbia, Virginia, Maine, Texas, Kentucky, South Carolina, and North Carolina.

Probable date of completion.—Two to four years.

Assignment.—E. B. McCormick.

Total, Field Experiments, $65,000.

IRRIGATION INVESTIGATIONS.

Supervision:

Object.—To supervise irrigation investigations and direct the editorial, clerical, and other routine work.

Location.—Washington, D. C.

Date begun.—1899.

Assignment.—Samuel Fortier.

Proposed expenditures, 1915–16.—$16,545 (research, $14,345; extension, $2,200).

[Research.]

Utilization of Water in Irrigation:

Object.—To determine what constitutes the best utilization of water in irrigation, as to quantity used and method of applying, to serve as a basis for irrigation practice, for designing canals, pumping plants, and farm ditches, for formulating ditch regulations and contracts, and for the granting and adjudicating of water rights.

Procedure.—In the arid region the utilization of water in irrigation has been studied in four ways: (1) The quantity of water used and the area upon which it is used has been measured in a great many instances as a basis for more exact studies of what should be used; (2) different quantities of water have been applied to the same crop under similar conditions, to determine what quantity produced the best results under field conditions; (3) the application of water to fields by different methods and in different quantities, preceded and followed by soil-moisture determinations, to determine what part of the water used is retained by the soil within the root zone of plants and what methods give the most even distribution of moisture throughout the fields; and (4) tank experiments, in which exact determination of the water used by crops at various stages of growth and the crops produced are made by periodical weighings. In the humid States plants are designed for farmers, principally truck and fruit growers, who wish to undertake irrigation, and careful records of cost and returns are kept.

Cooperation.—States of Arizona, California, Nevada, and Wyoming, under direct appropriations; in California, Colorado, Idaho, Kansas, Montana, Nebraska, New Mexico, Oregon, and Utah, under agreements with the experiment stations.

Location.—Salt River Valley, Ariz.; Davis Farm; Sacramento Valley and Imperial Valley, Cal.; Fort Collins, Colo.; Twin Falls and Gooding, Idaho; Garden City, Kans.; Billings and Bozeman, Mont.; Humboldt Valley, Nev.; Mesilla Valley, N. Mex.; eastern Oregon; lower Rio Grande Valley, Tex.; Cache Valley, Utah; typical stream valleys in Wyoming not yet determined upon; and throughout the Eastern States.

Date begun.—1899.

Results.—A large amount of data on duty of water and methods of irrigation has been published in former years. During the past year a report of cooperative work in Idaho covering five years was published by the State of Idaho and a report based on the same work prepared for publication by the department. A report on cooperative experiments covering two years' work at Billings, Mont., has been prepared, but not submitted for publication. A report covering two years' cooperative work in Nevada has also been prepared, but not yet presented for publication. A similar report of cooperative work in New Mexico has been received. Many of the data received are not conclusive and will be held and considered with the results of future work along the same line. In the East, advice has been given to many farmers and reports describing methods and giving results have been prepared.

Assignment.—Samuel Fortier.

Proposed expenditures, 1915–16.—$43,360.

Pumping for Irrigation:

Object.—To investigate the adaptation of pumping machinery to supplying water for irrigation and determine the cost of installation, maintenance, and operation of wells and pumping machinery. Most of the land of the Great Plains and much of that in other sections must be irrigated with water pumped from wells if it is ever reclaimed, and the small pumping plant supplying water to the individual farm is the most eco-

Pumping for Irrigation—Continued.

nomical unit. Work of two kinds is needed in this field: (1) Technical investigations to work out improvements in the design of pumps for irrigation and (2) study of the operation of pumping plants in the field, to secure a better adaptation of the equipment to the conditions under which it is working and to collect information as to cost of installing and operating pumping machinery, in order to make it possible to advise farmers as to equipment and as to the practicability of obtaining a water supply by pumping under their conditions.

Procedure.—Mechanical tests are made under laboratory conditions and in the field to determine the mechanical efficiency of plants as a whole and of the pumps and engines. Records of the season's operations of pumps in use, including the time run, quantity of water pumped, quantity of fuel used, and cost of attendance, fuel, lubricating oil, and repairs, are kept by farmers, who are paid a small sum for keeping the records. Mechanical tests of the plants for which records are kept are made where possible. It is proposed to extend considerably for the next two seasons the testing of pumping plants in use and the collection of information as to the cost of pumping under field conditions.

Cooperation.—California State Department of Engineering; University of California; Kansas, Nebraska, and Utah experiment stations; State engineer of Nevada; Nevada State University.

Location.—Vicinity of Los Angeles, Cal.; Garden City, Kans., and vicinity; western Nebraska; Las Cruces and Deming, N. Mex.; and several points in Nevada and Utah.

Date begun.—1899.

Results.—Several bulletins giving the results of pumping investigations have been published by the Office of Experiment Stations in the past. Data were published in O. E. S. Bulletins 181, 183, 191, and 201, and Farmers' Bulletins 277 and 394. During the past year a general treatise on pumping for irrigation has been prepared; also reports of pump tests in Kansas, on the operating costs of pumping plants in Nebraska, on tests of pumping plants in Idaho, and regarding a laboratory test of one pump.

Assignment.—Samuel Fortier.

Proposed expenditures, 1915–16.—$13,000.

Irrigation Appliances and Equipment:

Object.—To develop the best types of structures and equipment generally for diverting, transporting, dividing, distributing, and applying water used for irrigation. This will afford a basis for advising farmers as to improving present practices in regard to the kind of equipment to install.

Procedure.—This investigation consists principally of observing structures in use and studying their adaptation to the purposes which they are intended to serve, and the preparation of reports.

Cooperation.—University of California.

Location.—Throughout the United States. The nature of the work is such that it can not be localized, although much of it is done in the Eastern States, where irrigation is not generally practiced.

Date begun.—1899.

Results.—Many of the results of work of this kind have been published in Farmers' Bulletins in the past. More recently bulletins on gate structures (Department Bulletin 115), concrete linings for canals (Department Bulletin 126), and wood-stave pipe (Department Bulletin 155) have been published. During the past year the field work for a similar report on chutes and drops has been done and manuscript reports on equipment for subirrigation and overhead spray systems prepared. Local investigations have been made at many points in the humid section and plans prepared.

Assignment.—Samuel Fortier.

Proposed expenditures, 1915–16.—$9,000.

Flow of Water for Irrigation in Ditches, Pipes, and Other Conduits:

Object.—To test the accuracy of formulas for the flow of water in conduits of various kinds and to work out new formulas, in order that conduits may be properly designed to carry the water which they are intended to convey.

Procedure.—Very careful and accurate measurements of the discharge of existing conduits are made, and from the results existing formulas are checked and new formulas developed.

Flow of Water for Irrigation in Ditches, Pipes, and Other Conduits—Cont'd.

Cooperation.—Reclamation Service.

Location.—Throughout the United States. As the observations are made on conduits already installed, they are made wherever the desired kinds of conduits are found.

Date begun.—Some work of this character was done in 1900–1901 and at various times since. This work has been continuous since 1913.

Results.—Many data have been obtained, but nothing had been published until 1914. The results of measurements of flow in concrete-lined channels have been published in Department Bulletin 126, and the results of measurements on open channels generally have been published in Department Bulletin 194. The field work for a report on the flow of water in wood-stave pipe was done during the summer of 1914, but the results are not yet ready for publication.

Probable date of completion.—1917.

Assignment.—Samuel Fortier.

Proposed expenditures, 1915–16.—$8,500.

Measurement of Water for Irrigation:

Object.—The improvement and standardization of devices for measuring water for irrigation. The economical use of water and good agricultural practice require that the water used in irrigation be measured. Up to the present time no satisfactory means for measuring the small streams delivered to individual farmers have been devised, while the devices which are in use have not been accurately calibrated.

Procedure.—A hydraulic laboratory is maintained at Fort Collins, Colo., in cooperation with the Colorado Experiment Station, where the flow through various measuring devices is checked by volumetric measurements in carefully calibrated tanks. Discharge formulas and discharge tables are developed from the results of these experiments. New devices will be tested and experiments to develop more satisfactory methods made. At the Davis Farm of the University of California the discharges of the measuring devices used in that State and elsewhere are checked against standard weirs.

Cooperation.—Work in Colorado is done under cooperative agreement with the Colorado Experiment Station and that in California under agreement with the University of California.

Location.—Fort Collins, Colo., and Davis, Cal.

Date begun.—1899

Results.—Several reports of the work at the Fort Collins laboratory have been submitted for publication by the department within the past year but have not yet been published. A report of work at Davis has been published by the University of California and one report on a local measuring device has been approved for publication by the Colorado Experiment Station.

Assignment.—Samuel Fortier.

Proposed expenditures.—$6,700.

Customs, Regulations, and Laws Relating to Irrigation:

Object.—To determine the effect of customs, regulations, and laws upon the economical use of water in irrigation and upon the success of irrigation development.

Procedure.—The regulations, contracts, by-laws, etc., under which water is delivered to farmers are collected and their operations studied in the field. The laws relating to irrigation and judicial decrees interpreting these laws are compiled. The operation and effect of the laws are studied in the field.

Cooperation.—State Engineering Department of California, University of California, and Utah Experiment Station.

Location.—Headquarters at Washington, D. C.; work covers entire country.

Date begun.—1899.

Results.—For several years after beginning irrigation investigations a large part of the work done was of the character outlined in this project, and a number of bulletins giving the results have been published, including Office of Experiment Stations Bulletins 60, 70, 100, 105, 130, 144, 168, 190, 192, and 229. During the past year a report on the operations under the irrigation district laws of the Western States was partially prepared,

Customs, Regulations, and Laws Relating to Irrigation—Continued.
and reports on cooperative irrigation enterprises and the mutual water companies of southern California are in preparation.
Assignment.—Samuel Fortier.
Proposed expenditures, 1915–16.—$8,000.

[Extension.]

Expert Advice and Assistance:
Object.—To assist in irrigation development and the improvement of irrigation practices by advising as to methods and equipment for irrigation.
Procedure.—A large part of this work consists in replying to letters asking for information or advice. In some instances, particularly in the East, engineers visit farmers, investigate their conditions, and give the necessary advice as to equipment and instructions for its installation.
Cooperation.—Owners of plants.
Location.—Headquarters at Washington, D. C.; work covers the whole country.
Date begun.—1899.
Results.—Several plants have been installed under the direction of this office and are in successful operation.
Assignment.—Samuel Fortier.
Proposed expenditures, 1915–16.—$13,940.

Total, Irrigation Investigations, $119,045 (research, $102,905; extension, $16,140).

DRAINAGE INVESTIGATIONS.

Supervision:
Object.—To supervise drainage investigations, including necessary clerical and other routine work, purchase of equipment and supplies, etc.
Location.—Washington, D. C.
Date begun.—1903.
Assignment.—S. H. McCrory.
Proposed expenditures, 1915–16.—$17,781 (research, $13,281; extension, $4,500).

[Research.]

Construction, Operation, and Maintenance of Drainage Improvements:
Object.—To study the cost and efficiency of machines and implements for digging ditches and building levees under the various conditions of work; study the types, sizes, and arrangement of pumping equipment suitable for drainage works; investigate the strength and durability of tile, especialy of cement tile in alkaline soils; and make a study of the costs of construction, operation, and maintenance of drainage improvements and an analysis of such costs.
Procedure.—Data are collected by correspondence and by personal inspection from manufacturers, owners, and operators of equipment, from officers of drainage districts, and from individuals.
Cooperation.—Bureau of Standards and Association of American Portland Cement Manufacturers.
Location.—United States.
Date begun.—1903.
Results.—Data in Department Bulletin 71, "Wet Lands of Southern Louisiana and Their Drainage"; data also collected for a revision of Office of Experiment Stations Bulletin 243, "Drainage by Means of Pumps," and for bulletins on maintenance and management of drainage districts, trenching machinery for tile-drainage construction, and excavating machinery used in land drainage; and manuscript submitted on the manufacture, use, and durability of cement and clay drain tile.
Assignment.—S. H. McCrory.
Proposed expenditures, 1915–16.—$5,750.

Drainage of Peat, Turf, and Muck Soils:
Object.—To study special problems involved in planning and constructing drainage systems for peat, turf, and muck soils.
Procedure.—One of the principal investigations will be to determine the amount of shrinkage or contraction of such soils after drainage improvements have been installed. The relative advantages and disadvantages of open ditches and tile drains in such soils will be determined. The in-

Drainage of Peat, Turf, and Muck Soils—Continued.

vestigations should determine the rapidity with which the excess water should be removed from such soils and the height at which the ground water must be maintained to provide sufficient moisture for profitable agriculture.

Location.—Southern Louisiana, Florida, North Carolina, South Carolina, New Jersey, New York, and California.

Date begun.—1908.

Results.—Only limited investigations of this nature have been made heretofore, but the results conclusively indicate that material shrinkage occurs after drainage systems are installed.

Assignment.—S. H. McCrory.

Proposed expenditures, 1915–16.—$5,500.

Farm Drainage:

Object.—To determine the proper depth, spacing, and arrangement of tile drains in various types of soils, the carrying capacities of tile drains, and the effect of drainage upon the soil temperature; to ascertain the amount of water that should be removed by tile drains per day from various kinds of soil under varying conditions of climate and topography; and to determine the effect of drainage on crop yields.

Procedure.—Accurate data are obtained to compare the effectiveness of drains variously arranged in different kinds of soil, to compare drained with undrained tracts, and to compare conditions on the same tracts before and after drainage. Measurements of flow from farm-drainage systems are observed in connection with the degree of drainage afforded by the drains. The necessary observations are made largely upon the tracts selected for farm-drainage extension work. Some tests to determine the capacities of tile drains at various slopes will be made by laboratory methods on the Arlington (Va.) Experiment Farm.

Cooperation.—North Carolina Department of Agriculture, Alabama Experiment Station, and interested landowners.

Location.—Middle and South Atlantic States and Lower Mississippi Valley; particularly Maryland, Virginia, North Carolina, and Alabama.

Date begun.—1913.

Results.—A brief report on the effect of tile drains on ground-water level on an experimental tract in Montgomery County, Ala., has been distributed rather widely in mimeographed form. An article on "Economy of Farm Drainage," based upon data obtained in various States, has been published in the Department Yearbook for 1914. From the observations and investigations made in the past, standard instructions for the construction of tile drains, with illustrations of construction methods, have been prepared and widely circulated.

Assignment.—S. H. McCrory.

Proposed expenditures, 1915–16.—$13,980.

Drainage of Irrigated Lands:

Object.—To determine the best methods of overcoming injury to agricultural lands caused by seepage and accumulations of alkali and how to prevent such injury.

Procedure.—On the experimental tracts where drains have been installed observations will be made to determine the effectiveness of the drains at various depths and spacings in the various kinds of soil, upon the ground water elevation, and upon the distribution of the salts in the soil. Measurements are made of the flow from drains. On some of the tracts experiments will be made to determine the effect of flooding in connection with the drains for washing out the salts. Investigations are made of the effectiveness of relief wells to supplement the usual horizontal drains in giving outlet to ground water confined under pressure at considerable depth. Movements of ground water both laterally and vertically are studied in relation to soil structure.

Cooperation.—California Experiment Station, drainage districts, Twin Falls (Idaho) Canal Co., and individuals.

Location.—The arid regions of the United States, particularly Brownsville, Tex.; Pecos Valley, N. Mex.; Arkansas, Grand, and San Luis Valleys, Colo.; Salt Lake Valley, Utah; Kearney Park, Cal.; Boise Valley and Twin Falls area, Idaho; and Yakima Valley, Wash.

Date begun.—1903.

Drainage of Irrigated Lands—Continued.

Results.—Data in Department Bulletin 190, "Drainage of Irrigated Land." Bulletins are in course of preparation on the drainage of Grand Valley, Colo., and on the drainage of shale lands. A large number of tracts which were almost unproductive have been made profitably productive by installing drainage systems in accordance with the methods advocated by the department. It has been demonstrated that in irrigated lands the drains must be 5 to 8 feet deep to be effective. Under conditions not infrequently met it has been determined that relief wells to a depth of 15 to 30 feet and deeper are necessary to supplement the drains.

Assignment.—S. H. McCrory.

Proposed expenditures, 1915–16.—$27,000.

Organization, Financing, and Legal Regulation of Drainage Districts:

Object.—To study the organization of drainage districts and the laws under which such districts are formed; investigate the various methods of financing drainage districts; determine the effect of customs and drainage laws and regulations upon the economical organization of drainage districts; and study the various methods of drainage-improvement assessments.

Procedure.—By correspondence and personal interview with bonding-house officials, attorneys of drainage districts and bonding houses, and drainage-district officials. A study will be made of the reasons for the failure of drainage districts to meet their obligations and of the number of such failures. Advice will be given officials of proposed and organized districts in proper methods of procedure in organization and in disposing of securities to raise funds for the payment for improvements. An endeavor will be made to keep in close personal touch with districts from their inception, so that the greatest possible amount of authentic information may be collected. Addresses will be made at meetings of drainage associations and district officials on the subjects above mentioned.

Location.—United States.

Date begun.—1909.

Results.—Drainage laws have been passed in Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Idaho, Utah, Washington, New Mexico, Alabama, and Mississippi, in framing which representatives of the Division of Drainage Investigations have offered helpful suggestions. A small amount of data relative to the financing of drainage districts has been collected.

Assignment.—S. H. McCrory.

Proposed expenditures, 1915–16.—$4,300.

Run-Off Investigations:

Object.—To determine the rates of run-off which must be provided for by drainage channels in reclaiming wet lands and to determine the sizes of ditches necessary to remove the run-off.

Procedure.—Gaugings are made of the rates of flood flow from drainage basins of known area. As this rate is greatly affected by rainfall, topography, character of soil and vegetation, season, and size and shape of the drainage basin with reference to the arrangement of the tributary watercourses, data are collected relative to these conditions. In favorable locations actual measurements are made of the size and shape of the channel, slope of the water surface, and quantity of flow, and the condition of the channel with respect to roughness and uniformity is noted.

Cooperation.—Geological Survey and private engineers working in the vicinity where the investigations are being conducted.

Location.—Mississippi, Arkansas, Louisiana, Georgia, South Carolina, North Carolina, and Idaho.

Date begun.—1908.

Results.—Data collected in Illinois, Iowa, Louisiana, and Mississippi have been compiled and an extended distribution in mimeographed form made among engineers and persons interested in drainage reclamation. In addition, data representing several years' investigations in Missouri, Arkansas, Mississippi, Louisiana, and Tennessee are now being compiled in report form with a view to publication.

Assignment.—S. H. McCrory.

Proposed expenditures, 1915–16.—$8,800.

Drainage of Tidal Marshes:

Object.—To investigate the causes of failure in many attempts made to reclaim tidal marshland; and to determine the proper size and arrangement of sluice openings and the requisite storage capacity of ditches.

Procedure.—Examinations are made of areas where attempts have been made to embank and drain such land, and studies of the methods and cost of the work and the benefits obtained are conducted.

Cooperation.—California Experiment Station.

Location.—Atlantic and Pacific coasts, particularly along San Francisco Bay.

Date begun.—1903.

Results.—Data published in Office of Experiment Stations Bulletin 240, "Tidal Marshes and Their Reclamation." No investigations made since the publication of this report.

Probable date of completion.—Work on San Francisco Bay, 1917.

Assignment.—S. H. McCrory.

Proposed expenditures, 1915–16.—$3,300.

[Extension.]

Farm Drainage:

Object.—To teach landowners the proper methods of planning and constructing farm drains and terraces and to inform them concerning the benefits to be derived from such improvements.

Procedure.—From the requests received for assistance, representative farms which will serve as good demonstrations are selected, consideration being given to the location of the farm and the methods of farming practiced by the owner. A drainage or terrace system is designed and advice given during the construction of the system. In farming communities where farm drainage or terracing is not practiced, meetings of farmers are addressed for the purpose of creating an interest in these forms of land improvement.

Cooperation.—North Carolina Department of Agriculture, Alabama Experiment Station, and representative farmers and interested landowners.

Location.—Middle and South Atlantic States and lower Mississippi Valley; particularly Virginia, West Virginia, Georgia, Kentucky, and South Carolina

Date begun.—1903.

Results.—Data published in Maryland Experiment Station Bulletin 186, "Land Drainage in Maryland." Bulletins on tile drainage and methods of drainage, relating to conditions in Virginia, North Carolina, South Carolina, and Alabama, are in course of preparation. A large number of tile systems and a few terrace systems in North Carolina and Georgia have been installed by the landowners according to plans prepared by various engineers of the department. These systems are effective demonstrations of the benefits of drainage in increased crop yields as well as ease of cultivation and certainty of crops.

Assignment.—S. H. McCrory.

Proposed expenditures, 1915–16.—$8,700.

Drainage of Overflowed Lands:

Object.—To promote interest in the reclamation of overflowed lands with a view to making them available for agriculture.

Procedure.—Surveys are made and plans prepared for the drainage of representative districts, selection of districts being made from requests received by the office. Meetings of interested landowners are addressed to explain the improvements needed and ways of organizing efficiently.

Cooperation.—Individuals, communities, and proposed drainage districts.

Location.—Kootenai Valley, Idaho; Panther Creek Drainage District and Mayfield Creek Drainage District, Kentucky; and the Piedmont section of North Carolina and South Carolina.

Date begun.—1903.

Results.—Surveys and plans have been made and reports published on the Cypress Creek Drainage District in Arkansas (300,000 acres) and the Big Black River Drainage District in Mississippi (133,400 acres). The survey of the Kootenai River Valley Drainage District has been completed. Many small dstricts in the Piedmont section of North Carolina, South

Drainage of Overflowed Lands—Continued.

Carolina, and Georgia which the office has served in an advisory capacity are now engaged on construction work.

Assignment.—S. H. McCrory.

Proposed expenditures, 1915–16.—$10,800.

Drainage of Swamp Lands:

Object.—To promote interest in the reclamation of swamp lands, with a view to making them available for agriculture.

Procedure.—Surveys are made and plans prepared for the drainage of representative districts. From the requests for assistance received by the office only those districts are selected which it is believed will serve as object lessons in swamp reclamation. Meetings of interested landowners are addressed to explain the character of improvements needed and the methods which should be pursued in effecting an adequate organization.

Cooperation.—Individuals, communities, and proposed drainage districts.

Location.—Pleasant Grove Drainage District, Virginia; Cowcastle Swamp Drainage District, South Carolina; and Jefferson County, Tex.

Date begun.—1903.

Results.—Department Bulletin 193, "Report on the Drainage of Jefferson County, Texas," has been published. Surveys and plans have been made for the Cowcastle Swamp Drainage District, South Carolina (42,300 acres). Engineers have conferred with officials of the Pleasant Grove Drainage District, Virginia, and many smaller districts, advising how they might proceed with their work along proper lines.

Assignment.—S. H. McCrory.

Proposed expenditures, 1915–16.—$5,500.

Total, Drainage Investigations, $111,411 (research, $81,911; extension, $29,500).

[Research.]

INVESTIGATIONS IN RURAL ENGINEERING.

Rural Engineering:

Object.—To investigate farm domestic water supplies and drainage disposal, the construction of farm buildings, and other rural-engineering problems involving mechanical principles.

Procedure.—Farm-to-farm investigations are made to determine present practices in domestic water supply, in drainage disposal, and in constructing farm buildings as an aid in developing practical plans for the farmstead, its buildings, and their accessories. The better examples found are prepared for publications, with suggested improvements. Field investigations are being carried out in the Northwest wheat belt to discover the causes of dust explosions in thrashing machines and to devise preventive measures. Assistance will be rendered the pathologists and entomologists of the department in devising improved spraying apparatus.

Cooperation.—Forest Service, at the Forest Products Laboratory, Madison, Wis., and farm owners who agree to build from department plans and to furnish cost items, etc., for future bulletins; Bureau of Chemistry and the Bureau of Mines of the Department of the Interior, in the investigations of the wheat-dust explosions; Bureaus of Plant Industry and Entomology, in investigations of spraying machinery.

Location.—Washington, D. C., and elsewhere in the United States.

Date begun.—July 1, 1915.

Results.—Since this is a new division, no definite results have been attained, save that an immense amount of correspondence has been referred to this division for attention.

Assignment.—E. B. McCormick.

Proposed expenditures, 1915–16.—$14,502.

OFFICE OF MARKETS AND RURAL ORGANIZATION.

ADMINISTRATION.

Administration:

Object.—Supervision of the investigational, experimental, demonstrational, and regulatory work of the projects conducted by the Office of Markets and Rural Organization, and the execution of the necessary administrative work connected therewith.

Location.—Washington, D. C.

Date begun.—1913.

Assignment.—Charles J. Brand, R. V. Bailey, Caroline B. Sherman.

Proposed expenditures, 1915–16.—$52,630.

[Research.]

MARKETING AND DISTRIBUTION.

Cotton Handling and Marketing:

Object.—To investigate the commercial processes involved in the handling, marketing, and utilization of cotton, in order to make recommendations as to improvements and economies; to conduct investigational work in connection with the organization of communities of cotton growers to market their product; and to make experiments regarding the advantage of growing cotton from pure seed in these communities.

Procedure.—Present methods of handling and marketing the cotton crop are investigated; assistance is given to cooperative organizations in handling and marketing cotton; studies are made to determine the value to growers of grading cotton before sale; experiments are made to ascertain the relative commercial value of pure-bred varieties of cotton and the percentage of moisture in cotton at the gins, compresses, and other concentration points; primary market surveys will be undertaken to determine geographical production and the quality and variety of long-staple cottons.

Cooperation.—Informal cooperation with the Office of Extension Work in the South, States Relations Service; and with several agricultural and mechanical colleges of the South.

Location.—Washington, D. C., and field investigations in all of the cotton-growing States, particularly North Carolina, South Carolina, Arkansas, Oklahoma, and Texas.

Date begun.—1912.

Results.—During the fiscal year 1915 a survey was made of primary market conditions in Texas and Oklahoma. In the fall of 1914 a study was made, in cooperation with the experiment station of the North Carolina Agricultural and Mechanical College, of market conditions in Edgecombe County, N. C., in which cotton was graded by a representative of the department to determine its grade before sale; and a market survey was made in towns adjacent to this county, in order to form a basis of comparison between prices received for cotton sold before grading and those obtained on graded cotton in Edgecombe County. Assistance was given to the various farmers' organizations at points in the cotton belt, especially at Scott, Atkins, and Little Rock, Ark., and at Sacaton, Mesa, Tempe, Phoenix, and Glendale, Ariz., in the handling and marketing of cotton grown at these places and graded prior to sale. Some of the results of these investigations are described under the new projects, "Cotton warehousing investigations" and "Marketing cotton seed and its products." Publications: Farmers' Bulletin 641 (Agricultural Outlook), "The Cooperative Marketing of Cotton"; Department Bulletin 121, "Spinning Tests of Upland Long-Staple Cottons"; Department Bulletin 146, "Economic Conditions in the Sea Island Cotton Industry"; Depart-

Cotton Handling and Marketing—Continued.

ment Bulletin 216, "Cotton Warehouses; Storage Facilities Now Available in the South"; Department Bulletin 277, "Cotton Warehouse Construction."

Assignment.—Fred Taylor, D. C. Griffith, J. G. Martin, C. F. Creswell, O. J. McConnell, L. W. Kellner.

Proposed expenditures, 1915–16.—$23,300.

Cooperative Purchasing and Marketing:

Object.—To investigate cooperative and semicooperative associations formed for the purpose of marketing and distributing or purchasing farm products and to discover the forms of organization and methods of management best suited to their use. (For demonstration types of organizations, see "Extension and demonstration work.")

Procedure.—Plans for the future involve a continuation of work conducted in the past, which has consisted of surveys of communities of producers and consumers, to determine the practicability of using cooperative methods of grading, packing, inspecting, marketing, and distributing or purchasing farm products and of utilizing or selling by-products of the farm.

Location.—Washington, D. C.; field work at various points throughout the United States as required.

Date begun.—1913.

Results.—Many of the results of this work are described under the head of "Marketing business practice," which, for the greater part of the fiscal year 1915 constituted a branch of this project. Personal visits have been made to organizations in all parts of the country for the purpose of studying forms of associations and business methods. Practical surveys of producing communities have been conducted for the purpose of assisting farmers to improve their marketing methods and to organize. The office has cooperated with the Colorado Fruit Growers' Auxiliary Committee in a comprehensive survey of the local associations in that State and the conditions affecting the distribution of Colorado fruit. Recommendations were made to the fruit growers, and a central cooperative association composed of many locals was formed. Plans are being perfected for a general improvement in the conditions of handling and marketing the Colorado fruit crops. A card index of about 11,000 farmers' associations has been compiled. Publications: Farmers' Bulletin 620 (Agricultural Outlook), "Marketing the Apple Crop"; Farmers' Bulletin 651 (Agricultural Outlook), "Apple Cold Storage Holdings and the Market"; Department Yearbook (1914) article, "Cooperative Marketing and Financing of Marketing Associations"; and Farmers' Bulletin 656, "The Community Egg Circle."

Assignment.—C. E. Bassett, C. W. Moomaw.

Proposed expenditures, 1915–16.—$21,400.

Market Surveys, Methods, and Costs:

Object.—To make comprehensive and detailed studies of the origin, movement, distribution, and consumption of market supplies of farm products, especially perishables, in order to accumulate and disseminate useful information relating to all phases of the subject, including available and prospective production; movement of products into storage, foreign shipments, or consumption; the various agencies by and through which farm products are handled, distributed, stored, and sold; costs of doing business through existing marketing channels; methods of inspection in vogue; and the value and practicability of an inspection service; to study existing sources of market information, price quotations, and market forecasts, especially with a view to determining the cost, value, and practicability of a comprehensive market news service.

Procedure.—Information is accumulated to show the areas of surplus production of specific crops, dates within which certain areas move crops, usual markets to which crops are shipped, volume of movement in previous years, and tendency to increase or decrease production. Study is made of market methods, whether by consignment, f. o. b. sales, or sales through private distributing organizations. At certain consuming centers accurate records are kept of receipts and prices of specific products, while sample shipments are traced from producer to consumer, an itemized account being kept of all charges, costs, profits, and losses. Investigations are conducted relative to storage, sale of farm products through

Market Surveys, Methods, and Costs—Continued.

auction companies, and cost and efficiency of existing inspection services. In 1916 special attention will be given to existing sources of market information and to experimental work in the inauguration of a limited market news service for specific crops and areas.

Cooperation.—Informal cooperation with the Bureau of Crop Estimates.

Location.—Washington, D. C.; in about 20 of the larger markets in the country; and in the most important shipping areas of the various perishable products, in succession.

Date begun.—1913.

Results.—During the fiscal year 1915 monthly statements were issued showing the quantity of apples held in cold storage in comparison with the holdings of the same storages on the first of the previous month and in 1913. Comprehensive lists of producers, growers' organizations, shippers, transportation agents and officials, and others from whom timely information may be secured have been compiled. Data have been secured and compiled showing the commercial production and movement of tomatoes, peaches, and cantaloupes. A large amount of the preliminary work has been done on which to build a news service for the apple and potato crops. A fairly complete news service for the strawberry and tomato crops was rendered through the 1915 season. Publications: Department Bulletin 237, "Strawberry Supply and Distribution in 1914"; Department Bulletin 266, "Outlets and Methods of Sale for Shippers of Fruits and Vegetables"; and Department Bulletin 267, "Methods of Wholesale Distribution of Fruits and Vegetables on Large Markets."

Assignment.—W. A. Sherman, O. W. Schleussner, J. W. Fisher, jr., J. H. Collins, P. C. Isbell, R. M. Peterson, A. D. Gail, jr., J. P. Klein, C. W. Dunning, H. F. Walker, Paul Froelich, J. C. Gilbert, J. W. Park, L. H. Martin.

Proposed expenditures, 1915–16.—$54,220.

Market Grades and Standards:

Object.—To encourage and educate growers and shippers properly to prepare their products for market, and to show them the vital need of fixed grades and standards for universal use, with a view to the ultimate national standardization of market grades, weights, measures, and packages, or containers. (For demonstrations in proper methods of packing and grading perishable fruits and vegetables, see "Extension and demonstration work.")

Procedure.—Careful investigations are being made of present methods of picking, handling, grading, packing, and shipping farm products; national, State, and city laws regarding the grades, packing, containers, and marking of farm products are being collected, studied, and compared; and existing types and sizes of boxes, baskets, hampers, crates, barrels, and other packages are being studied. A special study of the picking, handling, grading, and packing of boxed and barreled apples will be started when the 1915 crop is ready to harvest. A similar study in connection with the potato crop has been already commenced.

Location.—Washington, D. C., and in the producing sections and their markets.

Date begun.—1913.

Results.—Studies at point of production of methods used in gathering, handling, grading, packing, and shipping perishable products are developing valuable information. These studies involve extensive travel and much time, so that complete data have not been obtained on any specific crop. Tabulation has been made of data showing the standards of quality, type, and capacity of packages, and regarding grading rules and systems of inspection used by large shippers' and growers' cooperative marketing organizations. Suggestions from this office have been incorporated in several proposed State laws concerning the grading, packing, and marking of apples, and assistance has been rendered in shaping proposed national legislation standardizing fruit and vegetable containers. Methods of preparation and standards for use in marketing farm products by parcel post have been studied, with a view to aiding producers in direct marketing. Publications: Office of the Secretary Circular 48, "Marketing Maine Potatoes."

Assignment.—C. T. More, M. M. Stewart.

Proposed expenditures, 1915–16.—$12,400.

City Marketing and Distribution:

Object.—To investigate the distribution and marketing of farm products in cities, in order to determine and encourage the practice of best methods and to extend advisory aid to cities in establishing economical and efficient marketing systems.

Procedure.—Personal investigations are made of various municipal and privately owned public wholesale and retail markets offering points worthy of study, particular attention being paid to factors which will aid in the work of designing model markets of various types to answer the needs of different cities. Plans for 1916 work include the designing of correct and efficient systems for the administration of these markets, together with model sets of rules and regulations; comparative study of service, prices, and overhead expenses of various agencies for retail distribution; study of the ordinances regulating use by producers of streets and markets in larger cities; and special investigations of the service rendered by and the proper regulation of the huckstering and push-cart systems in large cities. A study will be conducted regarding the losses which result from waste and deterioration due to the inefficient operation of established wholesale or retail agencies and their faulty locations with reference to transportation agencies, consuming sections, etc.

Cooperation.—Office of Weights, Measures, and Markets of the District of Columbia (informal).

Location.—Washington, D. C., and in various cities throughout the United States.

Date begun.—1913.

Results.—During the past year surveys have been made of the marketing situation in Huntington and Parkersburg, W. Va., Rochester, N. Y., and Hartford and New Haven, Conn., and have been followed by detailed reports containing suggestions for improved marketing facilities. Municipal markets, wholesale terminal markets, and other marketing projects have been studied at Denver, Kansas City, Des Moines, Dubuque, Chicago, Detroit, Cleveland, Pittsburgh, Buffalo, Baltimore, and Boston and conferences held with market superintendents, city officials, etc. At the present time a complete survey is being conducted of municipal marketing activities in the United States. Publications: Department Yearbook Separate 636, "Retail Public Markets."

Assignment.—G. V. Branch, Achsah Lippincott.

Proposed expenditures, 1915–16.—$12,000.

Transportation and Storage:

Object.—To investigate the service furnished throughout the United States by common carriers of every kind in the matter of transportation of farm products, particularly perishables; to ascertain the need for more and better service in individual sections and to cooperate with the carriers in the inauguration of such service; to inform carriers as to the needs of shippers and instruct shippers as to their rights, duties, and responsibilities in the transportation of farm products; to determine the economic loss of foodstuffs from lack of sufficient storage—both cold and common—and on account of storage improperly located; and to secure from transportation companies more storage-in-transit privileges on farm products.

Procedure.—The character of service furnished at the present time is ascertained from carriers, and from shippers and shippers' associations is determined what better service is desired. Farmers and shippers of farm products are instructed and assisted by letter, personal conference, and publications. Accurate and complete data are obtained on the amount of storage available throughout the country, its character, and location. Plans for work during 1916 include completion of investigations regarding the extent to which the electric lines serving Washington city offer an efficient freight service and a survey of the less-than-carload service offered producers of fruit and vegetables by certain lines serving large eastern markets, in order to make recommendations for a better and more comprehensive service by other lines. Extensive investigations will be conducted of the economic loss of foodstuffs in transit between producer and consumer, due to faulty methods of grading, packing, and shipping, with a view to recommending means for its reduction. In connection with the market news service conducted under the project "Market

Transportation and Storage—Continued.

surveys, methods, and costs," the work of arranging with transportation companies for reports of the movement of perishable commodities will be continued by personal work in the field as the most effective method of securing desired results.

Cooperation.—Bureaus of Plant Industry, Animal Industry, and Chemistry; Interstate Commerce Commission; associations of farmers and shippers; associations, bureaus, and committees of claim, and traffic and other officials of common carriers.

Location.—Washington, D. C., and in the field.

Date begun.—1913.

Results.—In the fiscal year of 1915 assistance was given to the producers of grain in South Carolina in securing favorable transportation rates. Statistics secured from the carriers serving Columbia, S. C., Atlanta, Ga., and Birmingham, Ala., regarding the receipt from distant sections of farm and food products which could be produced nearer home were used in connection with the crop-diversification work in the South. Assistance in solving transportation problems has been given to farmers and shippers of farm products by letter and personal conference, and the cooperation of many railroad officials has been effectively solicited. Publications: Department Bulletin 191, "Demurrage Information for Farmers"; Farmers' Bulletin 611 (Agricultural Outlook), "Car Supply in Relation to Marketing the Wheat Crop of 1914"; Farmers' Bulletin 672 (Agricultural Outlook), "Utilization of Concentrating and Storage-in-Transit Arrangements in Connection with the Transportation of Farm Products."

Assignment.—G. C. White, T. F. Powell.

Proposed expenditures, 1915-16.—$12,000.

Miscellaneous Problems in Marketing and Cooperation:

Object.—To enable the Office of Markets and Rural Organization to cooperate effectively with those governmental agencies already conducting investigations in the marketing of specific products; to develop foreign markets where practicable, especially by a study of foreign methods and outlets; and to take up the study of new lines of work relating to the organization of rural communities and to the preparation, handling, preservation, and marketing of animal, food, and miscellaneous products not specifically provided for under other projects.

Cooperation.—Bureaus of Chemistry, Animal Industry, Plant Industry, and Crop Estimates, Forest Service, and Bureau of Foreign and Domestic Commerce, Department of Commerce.

Location.—Washington, D. C., and points in the field where necessary.

Date begun.—1914.

Results.—The work conducted during the past year is described under the projects "Marketing live stock, meats, and animal by-products," "Marketing dairy products," and "Grain, seeds, and hay marketing investigation," Publications: "Prices of Wheat to Producers in Kansas, etc.," House Document No. 1271, Sixty-third Congress.

Assignment.—Charles J. Brand.

Proposed expenditures, 1915-16.—$30,800.

Marketing by Parcel Post and Express:

Object.—To determine the feasibility, both from the physical and the economic viewpoint, of marketing farm products by parcel post and by express from producer to consumer direct, and to ascertain the best methods to be used.

Procedure.—Actual shipments are made both to and from Washington. Employees in the field experiment in bringing producers and consumers into business contact for direct marketing. Field studies are made of the determining factors for the success or failure of parcel-post marketing campaigns conducted by postmasters in a number of cities. During 1916 experiments will be made with various commodities, and it is hoped to complete the investigations with berries, cherries, and possibly other products.

Cooperation.—Post Office Department and Bureaus of Chemistry, Animal Industry, and Plant Industry.

Location.—Washington, D. C., Savannah and Atlanta, Ga., and various other cities and sections of the country as may be found advisable in the development of the work.

Marketing by Parcel Post and Express—Continued.

Date begun.—1913.

Results.—During the fiscal year 1915 shipments of more than 10,000 pounds of butter were made by parcel post, and experimental shipments of vegetables and deciduous and citrus fruits were conducted. Shipments of cane sirup and maple sirup have been begun. Definite information as to proper containers and conditions to meet the varied requirements is being accumulated.

Assignment.—Lewis B. Flohr, C. A. Burmeister, J. W. Law, C. C. Hawbaker.

Proposed expenditures, 1915-16.—$15,280.

Marketing Live Stock, Meats, and Animal By-Products.

Object.—To conduct a thorough study of existing markets and methods of marketing live stock through the large central and small local markets, including transportation, yardage, sale, and delivery of live stock, and the slaughter, packing, and wholesale and retail distribution of meat products and by-products derived therefrom; classification and grading of live stock and meats; and other allied subjects, with a view to improving the methods and reducing the cost of marketing live stock, meats, and animal by-products.

Procedure.—A complete descriptive and statistical compilation covering all centralized live-stock markets in the United States is in preparation, and periodical personal inspection of each of the large markets is proposed. A study of typical local markets in the East, South, corn belt, Northwest, Southwest, and Pacific slope is being conducted. Market classes and grades of live stock and meats at representative market points will be described and illustrated in detail, with a view to standardizing them as far as practicable and educating producers and consumers regarding market requirements. A study of marketing methods adapted to certain sections or conditions is in progress, including direct marketing of home-prepared meat products, municipal abattoirs, and cooperative marketing. Other important phases of the subject will receive attention. Where deemed advisable, assistance will be given to communities in solving their marketing problems and perfecting more economical and efficient methods of marketing live stock, meats, and animal by-products.

Cooperation.—Bureau of Animal Industry and various State and local agencies in Minnesota, Colorado, South Carolina, Louisiana, and other States.

Location.—Washington, D. C., and in the field.

Date begun.—1914, as a part of the project "Miscellaneous problems in marketing and cooperation."

Results.—A comprehensive report, entitled "Methods and Costs of Marketing and Slaughtering Meat Animals and of Marketing and Distributing Meat Products and By-Products," has been prepared. Studies of marketing live stock in the South, with special reference to recent abnormal conditions, and of live-stock shippers' associations have been conducted. Special investigations have been reported upon relative to market conditions, especially as affected by quarantine due to foot-and-mouth disease, retail market prices at Providence, R. I., and marketing live stock in Louisiana, with special reference to the New Orleans market.

Assignment.—Louis D. Hall, F. M. Simpson, S. W. Doty.

Proposed expenditures, 1915-16.—$23,000.

Marketing Business Practice:

Object.—To investigate the business practices of cooperative and farmers' marketing, distributing, purchasing, and rural business organizations and other marketing agencies, with special reference to their accounting systems and methods of auditing, business organization, and financing, and to devise suitable accounting systems for these organizations and agencies, for the purpose of increasing their efficiency. (Demonstrational activities are described under "Extension and demonstration work.")

Procedure.—Collection is made of accounting forms now being used by rural business and other organizations, individuals, and firms engaged in the marketing, distributing, and storing of agricultural products; investigations are conducted regarding the business practices and methods

Marketing Business Practice—Continued.

of financing these concerns; and uniform systems of accounting are constructed for their use and installed in various marketing agencies throughout the country for experimental operation. Plans for 1916 include cooperative work with the Dairy Division of the Bureau of Animal Industry in designing a uniform system of accounts for cooperative creameries; investigations relating to the business methods employed in handling agricultural products on a commission basis; the devising of uniform systems of accounts for commission houses, cooperative stores, and cooperative organizations engaged in the canning, preserving, and evaporating of fruit and vegetable by-products; and investigations of the business management and operation of these agencies.

Cooperation.—Various farmers' cooperative elevators, fruit and produce exchanges, creameries, commission houses, etc., in the experimental operation of accounting systems; Oregon Agricultural College, in investigational work, consisting of a survey of the business methods employed by organizations engaged in the cooperative canning and preserving of fruit and vegetable products; and Bureau of Animal Industry.

Location.—Washington, D. C., and in the field.

Date begun.—1913, as a part of the project "Cooperative purchasing and marketing."

Results.—Uniform systems of accounting for cooperative fruit associations, cooperative produce exchanges, and for farmers' elevators have been perfected and are available for use. Publications: Department Bulletin 225, "A System of Accounting for Cooperative Fruit Associations"; Department Bulletin 236, "A System of Accounts for Farmers' Cooperative Elevators"; and Department Bulletin 178, "Cooperative Organization Business Methods."

Assignment.—W. H. Kerr, G. A. Nahstoll, J. R. Humphrey.

Proposed expenditures, 1915–16.—$15,800.

Grain, Seeds, and Hay Marketing Investigations:

Object.—To investigate the primary marketing of spring and winter wheat, including especially the uses and abuses of dockage in the first sale, and the comparison of results in the case of grain passing from the farmer to the line, independent, or farmers' mutual elevator; the various methods of marketing corn and other grains and seeds both for domestic and export trade; future grain transactions and exchange practices; the "spread" in the marketing of various grains; grain storage, scalping, mixing and warehousing practices, track selling, and other subjects, in order to suggest possible improvements and economies in marketing the grain crop.

Procedure.—Plans for work on this project are not complete, as it has just been organized.

Cooperation.—Bureau of Plant Industry.

Location.—Washington, D. C., and points in the field, as necessary.

Date begun.—Established as a separate entity July 1, 1915; preliminary work has been conducted under the projects entitled "Transportation and storage" and "Miscellaneous problems in marketing and cooperation."

Results.—New work. (See "Miscellaneous problems in marketing and cooperation.")

Assignment.—Charles J. Brand, George Livingston, Karl B. Seeds.

Proposed expenditures, 1915–16.—$10,000.

Marketing Cotton Seed and Its Products:

Object.—To investigate present methods of handling, marketing, and utilizing cotton seed and some of its crude products, with a view to suggesting means whereby improvements may be made and economies effected, and to make studies regarding future trading, the establishment of standard grades, and the standardization of conditions under which cotton seed and its products are handled and stored.

Procedure.—Plans for further work involve experimental crushings to determine the efficiency of different kinds of equipment and methods of handling; studies of such subjects as State and Federal laws regulating the cottonseed industry; the various methods of handling cotton seed on the farm, at the gin, in transit, and in storage, and the effect of these methods on the resulting product; the business organization of the cotton-

Marketing Cotton Seed and Its Products—Continued.

seed and oil industry, including buying and selling for future delivery, the organization and operation of cottonseed oil mills by cooperative producers, the domestic and foreign utilization of cottonseed products, and the special methods of preparation necessary to meet the requirements of various markets.

Cooperation.—Bureaus of Animal and Plant Industry, Chemistry, and Entomology, and Office of the Solicitor; Bureau of Standards, Department of Commerce; Consular Bureau of the State Department; manufacturers of cottonseed oil; State officials and others.

Location.—Washington, D. C., and points in the field when required.

Date begun.—1914, as a part of the project "Cotton handling and marketing."

Results.—Study has been made of cooperative cottonseed oil mills at Minter City, Clarksdale, and Gulfport, Miss., and Mangum, Okla. General information relating to the whole subject of cottonseed marketing and utilization has been collected. Existing rules formulated by cottonseed crushers' associations, merchants' exchanges, etc., governing transactions in cottonseed products have been compiled, together with the rules prescribed for the grading of cotton seed, and recommendations have been made by this office as to consideration of moisture content as a factor in grading. Analyses of several thousand seed samples representative of the cottonseed belt have been collected in connection with a study of their moisture content. Miscellaneous inquiries have been answered by correspondence, personal conferences, etc.

Assignment.—H. T. Poe, jr.

Proposed expenditures, 1915–16.—$6,400.

Marketing Dairy Products:

Object.—To conduct a thorough study of the marketing of dairy products and dairy substitutes, including methods and costs of their preparation for market, market grades and classification of dairy products, market quotations and quotation systems, market requirements, market conditions, and related subjects, in order to suggest measures by which market conditions and methods may be improved and the cost of marketing dairy products reduced.

Procedure.—Descriptive and statistical information of the dairy-producing sections and leading dairy markets of the United States is being secured in a general survey. This will be supplemented by a more detailed study of various phases and factors of the marketing side of the dairy industry, which will be made by correspondence, through questionnaires, cooperating agencies, collaborators, and personal investigations by marketing specialists and assistants of this office. Plans for 1916 include a special study of marketing and distribution of milk direct from farmers to city customers and through city milk dealers to the retail trade; also of costs of marketing cream to creameries in the Middle West where cream shippers' associations are organized and individual farmers consign their cream direct to the creameries. Where deemed advisable, assistance will be given to communities in solving their marketing problems and in perfecting more efficient and economical methods of marketing dairy products.

Cooperation.—Bureaus of Animal Industry and Chemistry.

Location.—Washington, D. C., and the leading dairy-producing and dairy-marketing centers of the United States, as Minnesota, Iowa, Wisconsin, Michigan, Chicago, New York, Boston, etc.

Date begun.—1914, as a part of the project "Miscellaneous problems in marketing and cooperation."

Results.—A general survey of the operation of Minnesota and Wisconsin creameries has been completed and a special study made of the facilities and costs for transportation in marketing Minnesota creamery butter; of the shrinkage in marketing creamery butter; of systems and costs of marketing butter in Minneapolis, St. Paul, Chicago, New York, Jersey City, and Philadelphia; of comparative costs of different systems of marketing dairy products in the South, and the complete costs of marketing milk from about 175 New England dairies. Assistance has been given and recommendations made in a number of instances for improving marketing facilities, methods, and conditions.

Marketing Dairy Products—Continued.

Probable date of completion.—Studies of shrinkage, transportation, and cost of marketing Minnesota and Wisconsin butter should be completed by June 30, 1916.

Assignment.—Roy C. Potts, G. P. Warber, H. F. Meyer.

Proposed expenditures, 1915–16.—$13,200.

Cotton Warehousing Investigations:

Object.—To accumulate and disseminate useful information relating to the warehousing of cotton, insurance rates while in storage, and benefits, including better arrangements for financing, to be derived from conserving cotton in storage houses; the construction of different types of warehouses; and the relation of present methods and practices of compressing cotton to warehousing.

Procedure.—Study will be made of the standards for cotton warehouses recommended by insurance underwriters' associations, including costs and adaptability. Special attention will be given to State warehouse systems and to cooperative storage companies, with the view to aiding such systems and organizations where possible. Investigations will be made to determine the relation of warehouse facilities to the financing of the cotton crop and the interest rates on money loaned on cotton, and the relation of the various methods and practices of compressing cotton to storage capacity, insurance rates, and economy in handling and transportation. Conditions in Texas, Oklahoma, Arkansas, and the entire western part of the cotton belt probably will receive special attention during 1916.

Cooperation.—States Relations Service, State experiment stations, colleges of agriculture, private individuals, commercial companies, insurance companies, and others.

Location.—Washington, D. C., all of the cotton-growing States, and places outside of the cotton belt where cotton is centered and held in storage.

Date begun.—Carried on under "Cotton handling and marketing" project since the institution in 1913 of investigations touching on this subject; established as a separate project July 1, 1915.

Results.—Under the project "Cotton handling and marketing" a detailed survey was made in Georgia and North Carolina to determine storage capacities, availability, cost, construction, insurance rates, and adaptability of the warehouses and cotton-mill warehouses in these States and the willingness of banks to loan money on cotton offered as collateral. A tabulation of the location and storage capacity of the cotton warehouses now in use has been made. and they have been studied regarding cost of construction, conveniences offered, insurance rates paid on cotton stored therein, and various other factors affecting cotton in storage, special attention being given to the value of the warehouse in enabling the owners of cotton to obtain loans on cotton stored. Publications: Department Bulletin 216, "Cotton Warehouses; Storage Facilities Now Available in the South"; Department Bulletin 277, "Cotton Warehouse Construction."

Assignment.—R. L. Nixon, Roy L. Newton.

Proposed expenditures, 1915–16.—$7,700.

Total, Marketing and Distribution, $257,500.

[Research.]

INVESTIGATIONS AND DEMONSTRATIONS OF COTTON STANDARDS, AND COTTON TESTING.

Investigations and Demonstrations of Cotton Standards:

Object.—To make field and laboratory investigations and demonstrations of standards for the different grades, qualities, and conditions of cotton, and to investigate the ginning, grading, stapling, baling, marking, compressing, and tare of cotton. (The actual preparation and distribution of the cotton standards, established under the provisions of the United States cotton-futures act, is carried on under another project.)

Procedure.—Laboratory work: Extensive studies are being made relative to the classification and standardization of blue-tinged, yellow-tinged, and yellow-stained cotton, with a view to preparing standards representing

Investigations and Demonstrations of Cotton Standards—Continued.

these qualities. Tentative types of these colored cottons have been prepared, and their application to the trade is being studied. Methods for determining the exact length of staple are being considered, with a view to adopting some standard of length. Further studies will be made with a view to completing the determination of a standard representing Arizona-Egyptian cotton. A further study of the various grades, qualities, and conditions of cotton will be made, with the object of establishing standards of cotton representing perished staple, immature staple, and of gin-cut and reginned cotton and cotton linters.

Field work: The physical effect of the various processes of ginning, baling, and compressing on the grade and fiber of cotton are being investigated. When practicable, the services of grading experts will be furnished to communities of cotton growers to demonstrate proper methods, in order to secure more uniform grading in spot-cotton transactions and to show to these communities the advantages of proper grading and classification of cotton before sale. Similar work heretofore has been conducted under the project "Cotton handling and marketing" in an effort to bring about cooperation in cotton marketing. To the end that cotton quotations may be on a more uniform basis, grading and standardization demonstrations also will be conducted in certain spot markets. In all work of this character cooperation is maintained with the Office of Extension Work in the South, States Relations Service.

Cooperation.—States Relations Service; cotton gins and growers, interior buyers, cotton brokers, factors, compresses, cotton mills, and agricultural and mechanical colleges.

Location.—Laboratory work in Washington, D. C.; field work where necessary.

Date begun.—1907.

Results.—In order to unify the economic cotton work of the department, Congress transferred the item under which this work was conducted from the Bureau of Plant Industry to the Office of Markets and Rural Organization. Owing to the necessarily close relationship between all of the cotton activities, this arrangement makes possible a more economical handling of the work. During the greater part of the past fiscal year it actually was conducted in combination with that done by this office, in accordance with the plan of reorganization put into effect by the Secretary of Agriculture. The investigational and clerical staff is assigned, according to exigency, not only to the work outlined under this project group but also to assist in the project group formed in connection with the "Enforcement of the United States cotton-futures act" and for the field work in "Cotton handling and marketing." The standards which now represent white cotton were promulgated December 15, 1914, as the official cotton standards of the United States. Twenty-five full sets representing these standards are being stored in vacuum tubes in order to preserve their integrity. Publications: Farmers' Bulletin 591, "The Classification and Grading of Cotton," issued while this work was under the supervision of the Bureau of Plant Industry.

Assignment.—Fred Taylor, Harold C. Slade, T. C. Adams, H. B. Richardson, Emil Schulze.

Proposed expenditures, 1915–16.—$27,100.

Cotton Testing:

Object.—To ascertain the waste, tensile strength, and bleaching qualities of the different grades, classes, and varieties of cotton, in order to determine their commercial and spinning value, and to demonstrate the results of such tests.

Procedure.—Spinning tests are being conducted in cooperation with textile schools and several of the large cotton manufactories in New England. These tests are made on the basis of the official cotton standards of the United States, representing cotton of the Upland, Texas, and Gulf growths, with staple approximately fifteen-sixteenths of an inch in length, purchased from representative sections of the cotton belt. The standard grades of Egyptian cotton grown in the Salt River Valley in Arizona, now in process of formulation, are tested. After storage under suitable moisture conditions, these cottons will be run through the various manufacturing processes under similar mill conditions. The yarns manufac-

Cotton Testing—Continued.

tured will be tested for tensile strength; bleaching and mercerization experiments will be made on the raw cotton and finished yarn; and the true commercial value of the product will be obtained. Relative commercial values of the waste from each grade will be ascertained, the relative cost of manufacture being taken into consideration throughout the experiments.

Cooperation.—Pocasset Manufacturing Co., Fall River, Mass., New Bedford Textile School, New Bedford, Mass., and others.

Location.—Spinning tests at Fall River and New Bedford, Mass., Raleigh, N. C., and Clemson College, S. C., and in other localities; laboratory work in Washington, D. C.

Date begun.—1913.

Results.—The changes in the permissive standards, promulgated previous to the passage of the United States cotton-futures act, made it practically impossible to continue spinning tests on the basis of the old standards. The results of the tests made on the old standards have been prepared for publication but probably will be used in conjunction with tests to be made during 1916 on the new standards. Bales representing the various grades of the United States official cotton standards have been purchased from the coastal plains of the Atlantic States, the Piedmont section, and the coastal plains and black-land sections of Texas and Oklahoma, and spinning tests of the waste, tensile strength, and bleaching qualities of the different grades and classes will be made to determine their relative spinning values. Tests are now in progress to determine the relative value of the tentative grades of Arizona-Egyptian cotton standardized by this department, to determine the waste content, mercerization, and bleaching qualities of this product. Tests also are being made at the request of the Federal Horticultural Board to determine the effect of fumigation by hydrocyanic-acid gas, a process used on imported cotton for the purpose of destroying the larvæ of the pink bollworm.

Assignment.—Supervisory committee: Fred Taylor, W. R. Meadows, and D. E. Earle; W. S. Dean, G. H. Anderson, C. E. Coburn, J. J. W. Cooper, R. V. Hellams, C. E. Killingsworth.

Proposed expenditures, 1915–16.—$32,820.

Total, Investigations and Demonstrations of Cotton Standards, and Cotton Testing, $59,920.

[Research.]

RURAL ORGANIZATION.

Rural Credit, Insurance, and Communication:

Object.—To aid in solving problems relating to the organization of rural communities for the purpose of obtaining better credit, insurance, and communication facilities by the accumulation and dissemination of useful information relating to the various phases of the subject. (Field assistance in the work of organizing local communities for credit and insurance improvement is described under "Extension and demonstration work.")

Procedure.—Field investigations, supplemented by returns from questionnaires, personal correspondence, and by the study of official and other records, are being made of the following subjects: The existing successful organizations which are performing the functions of rural credit banks; organized activity among farmers for credit improvement; financing the breeding, feeding, and marketing of live stock; the uses and abuses of store and machinery credit; the problem of farm finance on reclamation projects in the West; various crop liens and leasing and tenancy systems; legislation affecting mortgage and personal farm credit; the nature and extent of losses in agriculture and the facilities most helpful in reducing such losses or minimizing such risks; and how efficient facilities for agricultural insurance may be best established and conducted; and organization for the improvement of methods of rural communication, especially between farms and in relation to local markets.

Cooperation.—Informal cooperation with the Bureaus of Plant Industry, Animal Industry, and Crop Estimates, States Relations Service, State agricultural colleges, various State departments, and local agencies.

Rural Credit, Insurance, and Communication—Continued.

Location.—Washington, D. C., and such points in the field as may be necessary.

Date begun.—1913.

Results.—A preliminary survey of farm-credit conditions in the United States has been completed, including an estimate of the amount of long and short time farm loans made by various classes of banks and interest rates on long and short time loans. Statistical and other data are at hand regarding agencies supplying farm loans in the United States; commissions and other items of cost connected with farm loans; financing conditions on the Truckee-Carson and Minidoka Reclamation Projects; the financing of live-stock enterprises by various agencies such as banks, commission companies, and cattle loan companies; store and machinery credit in selected localities, and legislation affecting rural credits. Assistance was rendered in the organization of cotton growers at Scott, Ark., for credit improvement. Information has been given to a number of States as well as to committees of Congress regarding legislation affecting rural credits. A preliminary survey has been completed of farmers' mutual insurance companies and farmers' telephone companies in the United States, and studies have been made of organization methods and results obtained by such companies in a number of States. Publications: Farmers' Bulletin 654, "How Farmers May Improve Their Personal Credit."

Assignment.—C. W. Thompson, V. N. Valgren.

Proposed expenditures, 1915–16.—$24,270.

Rural Social and Educational Activities:

Object.—To aid in the improvement of social and educational conditions in rural communities by the accumulation and dissemination of useful information growing out of the study of typical communities with reference to their social and educational needs, the work of their existing forms of organization, and the possibilities for improvement through organized activity; to investigate methods of encouraging social organization activities; and to study means of improving social, economic, and educational conditions of women and children through the work of women's rural organizations. (For demonstrational work in supplying suggested programs for local communities, see "Extension and demonstration work.")

Procedure.—Field studies are supplemented by information obtained from records and correspondence, questionnaires, etc. A general survey of women's rural organizations is being made. Plans are being perfected for supplying suggested programs periodically to local organizations.

Cooperation.—Informal cooperation with the Bureau of Education, Public Health Service, various bureaus and offices of the Department of Agriculture, State agricultural colleges, various State departments, and private agencies.

Location.—Washington, D. C., and points in the field, among which are included Chilton County, Ala., Orange County, N. C., and Albemarle County, Va.

Date begun.—1913.

Results.—Preliminary information has been secured regarding community organization work in different sections of the country. Special studies have been made of community organization activity for the improvement of conditions of health, recreation, household economy, civic betterment, etc., in certain States, including Massachusetts, New York, Pennsylvania, and Maryland. Information has been obtained also regarding local needs and methods of improvement along these lines. In Chilton County, Ala., helpful experimental studies have been conducted in rural nurse organizations, community fairs, "get-together" days, cleaning-up campaigns, and the federation of local organizations for social and educational programs. Publications: Department Yearbook, 1914 (Separate 632). "The Organization of a Rural Community."

Assignment.—C. W. Thompson, J. S. Moran, L. E. Truesdell, Anne M. Evans.

Proposed expenditures, 1915–16.—$14,730.

Total, Rural Organization, $39,000.

EXTENSION AND DEMONSTRATION WORK IN MARKETING AND DISTRIBUTION AND IN RURAL ORGANIZATION.

Extension and Demonstration Work:

Object.—To carry, by demonstration, to the people of the United States useful information relating to the marketing and distributing of farm products and the organization of rural interests.

Procedure.—(1) Demonstrations in proper methods of packing and grading perishable fruits and vegetables for market will, when practicable, be conducted at points of production in cooperation with producers and shippers. This work has grown out of the activities conducted under the research project "Market grades and standards." (2) Demonstrations of types of cooperative organizations for purchasing and marketing will be conducted, where deemed advisable, by assisting in the organization of communities of producers to handle, distribute, and market farm products and in the formation of associations of farmers and consumers to purchase foods and farm supplies. Suggestions and advice will be offered with regard to the improvement of marketing methods used by communities already organized. This work is the outgrowth of that conducted under the research project "Cooperative purchasing and marketing." (3) Efficient systems of accounting and business practice will be demonstrated and, when practicable, this office will assist in the installation of systems of accounts devised by it. This work is the outgrowth of the research work conducted under the projects "Cooperative purchasing and marketing" and "Marketing business practice," and the object is to improve the business efficiency of farmers' cooperative and noncooperative marketing, distributing, purchasing, and rural business organizations and agencies engaged in the marketing, distributing, and storing of agricultural products, with especial reference to their accounting systems, methods of auditing, and financing. Syllabi will be prepared for courses in marketing business practice. (4) Field assistance will be given in the organization of communities for credit, insurance, and social improvement, and suitable forms of agreement, by-laws, and other blanks necessary for this purpose will be supplied. Advice will be offered existing organizations with regard to improving credit, insurance, and social conditions. Similar work was done in the past under the projects "Rural credit, insurance, and communication" and "Rural social and educational activities." (5) State follow-up systems, which supply local communities regularly with suggested programs on social and economic topics of community interest, will be supplied for the purpose of stimulating and encouraging local community discussion. The programs will be accompanied by paragraph statements and references prepared with the assistance of proper State and Federal experts. Communities receiving these programs will be expected to report thereon periodically to a designated State official. (6) When practicable, field agents will be located in certain States to cooperate with existing agencies in the conduct of extension and demonstrational work relating to general or specific phases of handling, distributing, storing, and marketing farm products and the organization of rural interests.

Cooperation.—States Relations Service, various State authorities, agricultural colleges, etc.

Location.—Oregon, Kansas, South Carolina, Tennessee, and other States.

Date begun.—Recognized as extension work July 1, 1915.

Assignment.—Charles J. Brand, C. E. Bassett, C. W. Moomaw, W. A. Sherman, W. H. Kerr, Louis D. Hall, C. T. More, C. W. Thompson, Fred W. Hoffman, Turner Wright.

Proposed expenditures, 1915–16.—Allotments to be made from research projects as necessary.

ENFORCEMENT OF THE UNITED STATES COTTON-FUTURES ACT.

Administration:

Object.—To supervise and direct the investigational and regulatory activities of the Office of Markets and Rural Organization in connection with the enforcement of the United States cotton-futures act and the rules and regulations of the Secretary of Agriculture thereunder, and to perform such executive and clerical duties as may be necessary in connection therewith.

Cooperation.—Office of the Solicitor, in matters involving points of a legal nature and questions of general policy, and the Treasury Department, in matters pertaining to the work imposed by the act upon that department.

Location.—Washington, D. C.

Date begun.—August 18, 1914.

Results.—Publications: Office of the Secretary Circular 46, "Rules and Regulations of the Secretary of Agriculture under the United States Cotton-Futures Act of August 18, 1914," and amendments Nos. 1, 2, 3, and 4 thereto; Service and Regulatory Announcements Nos. 1, 2, 3, and 4, Office of Markets and Rural Organization.

Assignment.—Charles J. Brand. Board of examiners: Charles J. Brand, Wm. R. Meadows, Fred Taylor, H. B. Parker, D. E. Earle, D. C. Griffith, W. C. Neal, J. G. Martin, Hal Brown, O. J. McConnell, R. L. Crittenden, W. S. Dean, Harold C. Slade, R. L. Francis. Committee on final inspection: Fred Taylor, H. B. Parker, D. E. Earle, D. C. Griffith, Hal Brown, W. S. Dean, Harold C. Slade, W. E. Chambers, W. C. Neal.

Proposed expenditures, 1915–16.—$85,000 (research, $25,000; regulation, $60,000).

[Research.]

Investigations of Future and Spot Markets for Cotton:

Object.—To investigate future markets for cotton to ascertain how accurately their future quotations reflect spot values, and to secure general information as to conditions within the future exchanges; to investigate spot markets to determine their fitness for designation as bona fide spot markets; to secure daily reliable quotations for cotton from each of the designated spot markets; and to inspect the designated bona fide spot markets from time to time.

Procedure.—Investigations are made of transactions in future markets to ascertain whether the provisions of the act are being carried out, and of various spot markets to determine whether they are qualified for designation as bona fide spot markets, i. e., whether the exchanges in these markets will meet certain conditions necessary for the designation of same as bona fide spot markets. Quotations received from these bona fide spot markets are checked to determine that they are correct, and these designated bona fide spot markets are inspected from time to time to determine whether they continue to meet the requirements of a bona fide spot market.

Cooperation.—Cotton exchanges in the designated spot markets, the future exchanges at New York and New Orleans, the New England Cotton Buyers' Association, Boston, Mass., the Arkwright Club, Boston, Mass., and numerous cotton firms throughout the United States.

Location.—Washington, D. C., the cities mentioned below, and such other points as may become necessary.

Date begun.—1914.

Results.—At present the following cities constitute bona fide spot markets for cotton: Augusta, Ga., Dallas, Tex., Houston, Tex., Little Rock, Ark., Memphis, Tenn., Montgomery, Ala., Norfolk, Va., Savannah, Ga., Boston, Mass., New Orleans, La., Charleston, S. C., Mobile, Ala., Galveston, Tex. Quotations are received by this office and by each of the future exchanges at New York and New Orleans every business day from the first ten of the designated spot markets. Upon an average of these quotations are based the commercial differences for use in the settlement of future contracts.

Assignment.—Wm. R. Meadows, Wm. C. Neal, G. R. Argo.

Proposed expenditures, 1915–16.—$25,000.

Determination of Disputes:

Object.—To hear and determine disputes as to the grade, quality, or length of staple of cotton tendered in settlement of future contracts made in compliance with section 5 of the cotton-futures act and referred to the Secretary of Agriculture under the terms of the act; and to draw up memoranda of conclusions upon which are based the Secretary's findings in cases of dispute.

Procedure.—Under the United States cotton-futures act disputes as to the grade, quality, or length of staple of cotton tendered in settlement of future contracts may be referred by either party to the Secretary of Agriculture for his determination, by submitting a sample of each bale in dispute and filing the necessary papers relating thereto in accordance with regulation 2 of the rules and regulations of the Secretary of Agriculture. When these samples are received by the department they are placed in a vault until called for by the clerk to the examiners. They are placed then in convenient order for the examiners, who have been designated by the Secretary of Agriculture to pass judgment upon and render a memorandum of their conclusions as to the facts in dispute. A copy of this examiners' memorandum of conclusions is furnished to each of the parties to the dispute, and upon it are based the findings of the Secretary. These findings also are sent to the parties to the dispute and have the effect of prima facie evidence in all United States courts. A memorandum of the charges assessed against each party is prepared and forwarded to them in accordance with the provisions of section 31, paragraph 2, rules and regulations of the Secretary of Agriculture.

Cooperation.—Office of the Solicitor, in matters involving points of a legal nature, including the preparation of findings for the signature of the Secretary.

Location.—Washington, D. C. Temporary headquarters may be established at various points in the United States should occasion require, as provided in the rules and regulations of the Secretary of Agriculture under the United States cotton-futures act.

Date begun.—Preliminary work commenced shortly after August 18, 1914. The first dispute was referred to the Secretary on March 15, 1915.

Results.—To June 1, 1915, 418 disputes, involving 39,053 bales of cotton, had been referred to the Secretary, upon which findings have been issued. Since that date 105 disputes have been received. which are now in process of determination.

Assignment.—H. B. Parker, Robert L. Crittenden, R. L. Francis, Hal Brown, Thomas B. Mills, jr., E. T. Chassaignac, R. A. Freret. O. J. Field.

Proposed expenditures, 1915–16.—$30,000.

Preparation and Distribution of the Official Cotton Standards of the United States:

Object.—To prepare and distribute the official cotton standards of the United States, promulgated by the Secretary of Agriculture on December 15, 1914, under section 9 of the United States cotton-futures act; and to inspect and condemn these standards when necessary and replace them upon request. (Field and laboratory investigations and demonstrations of standards are carried on under another project.)

Procedure.—Bales of cotton of the various grades representing the characteristic qualities of the cotton of each State are purchased throughout the cotton belt and used for the preparation of copies of the official standards. These copies, certified under the seal of the Department of Agriculture and accompanied by photographs of the standards at the time of certification, are prepared in sets of nine boxes, each box representing a grade and containing therein 12 samples or types showing the degree of variation permissible within the grade. Sets of standards are sold at $20 each and are used as a basis for grading cotton in commercial transactions. Fractional or broken sets are supplied upon request. Purchasers of the standards hold them subject to inspection by representatives of the department, and if for any reason they are found on inspection to misrepresent the official cotton standards the certificate of grade may be canceled or removed. Examination of any set or box

Preparation and Distribution of the Official Cotton Standards of the United States—Continued.

delivered at Washington will be made free of charge, and any sample or type which may be out of line with the official cotton standards will be replaced at a nominal charge, the photograph of the box being renewed free of charge.

Location.—Washington, D. C.

Date begun.—1914.

Results.—The preparation and distribution of the official cotton standards to cotton exchanges and persons dealing in cotton. Up to June 1, 1915, 354 sets had been distributed throughout the United States and 14 sets had been sent to China, Japan, England, France, Canada, India, Germany, and Holland.

Assignment.—Fred Taylor, D. E. Earle, C. E. Atkinson, R. L. Kause, M. L. Rice, B. M. Botto.

Proposed expenditures, 1915–16.—$35,000.

Total, Enforcement of the United States Cotton-Futures Act, $175,000 (research, $50,000; regulation, $125,000).

INSECTICIDE AND FUNGICIDE BOARD.

ENFORCEMENT OF THE INSECTICIDE ACT.

Administration:

Object.—To act for the board in all matters pertaining to the enforcement of the insecticide act and incidental business affairs.

Procedure.—Samples of insecticides and fungicides are collected by inspectors operating throughout the United States, and samples from consignments offered for import at the various ports of entry are taken; distribution is made of such samples for analysis and test, and reports thereon are assembled and all necessary action taken to carry out the recommendations of the board in respect to the disposition of cases and administrative matters, including the arranging for hearings, collecting evidence, correspondence, preparing cases for reference to the Solicitor, maintaining records and files, attending to fiscal matters, purchasing and accounting for property, and all other business details.

Cooperation.—Bureaus of Animal Industry, Plant Industry, Chemistry, and Entomology, and Office of the Solicitor; and Treasury, Commerce, and State Departments.

Location.—Washington, D. C.

Date begun.—1910.

Results.—General compliance with the law is being obtained, resulting in great improvement in labeling and better and more standardized grades of the products appearing on the market.

Assignment.—J. K. Haywood, chairman of board; J. G. Shibley, executive officer.

Proposed expenditures, 1915–16.—$41,361 (regulation, $40,761; research, $600), including reserve of $11,000 for the trial of cases.

[Regulation.]

Routine Chemical, Microscopic, and Bacteriological Examination of Insecticides and Fungicides Other than Those Used on Horses, Cattle, Sheep, Swine, or Goats:

Object.—To control the traffic in domestic and foreign insecticides and fungicides of the type mentioned.

Procedure.—Samples of these insecticides and fungicides are collected in the open market and examined to determine whether or not they are adulterated or misbranded under the provisions of the insecticide act.

Cooperation.—Same as project "Administration."

Location.—Washington, D. C.

Date begun.—1910.

Results.—Same as project "Administration."

Assignment.—J. K. Haywood, chairman of board.

Proposed expenditures, 1915–16.—$28,806.

Routine Testing of Efficacy of Fungicides and Action on Foliage of Insecticides and Fungicides:

Object.—To control interstate traffic in domestic and foreign fungicides and insecticides.

Procedure.—Samples of fungicides and insecticides collected in the open market are tested to determine whether they are adulterated or misbranded under the provisions of the insecticide act.

Cooperation.—Same as project "Administration."

Location.—Washington, D. C.; Arlington, Va.; and leased orchards and truck patches.

Date begun.—1910.

Results.—Same as project "Administration."

Assignment.—M. B. Waite, member of board.

Proposed expenditures, 1915–16.—$6,262.

Routine Testing of Efficacy of Insecticides and Their Action on Foliage:

Object.—To control interstate traffic in domestic and foreign insecticides.

Procedure.—Samples of insecticides collected in the open market are tested to determine whether or not they are adulterated or misbranded under the provisions of the act.

Cooperation.—Same as project "Administration."

Location.—Washington, D. C., and Vienna, Va.

Date begun.—1910.

Results.—Same as project "Administration."

Assignment.—A. L. Quaintance, member of board.

Proposed expenditures, 1915–16.—$8,038.

Routine Chemical and Bacteriological Examination of Insecticides and Fungicides Used Primarily on Horses, Cattle, Sheep, Swine, or Goats, and Efficacy Tests of Same.

Object.—To control traffic in the domestic and foreign insecticides and fungicides of the type mentioned.

Procedure.—Samples of these insecticides and fungicides are collected in the open market and examined to determine whether or not they are adulterated or misbranded under the provisions of the insecticide act.

Cooperation.—Same as project "Administration."

Location.—Washington, D. C.

Date begun.—1910.

Results.—Same as project "Administration."

Assignment.—James A. Emery, member of board.

Proposed expenditures, 1915–16.—$8,633.

[Research.]

Chemical, Microscopic, and Bacteriological Investigations of Insecticides and Fungicides Other than Those Used on Horses, Cattle, Sheep, Swine, or Goats:

Object.—To obtain basic information relative to these insecticides and fungicides and of materials used in their preparation, which is necessary in the enforcement of the insecticide act, improve methods of examining insectides and fungicides, establish standards for insecticides and fungicides, and aid manufacturers in methods of manufacture.

Procedure.—As new questions arise relative to methods of analysis, standards for insecticides and fungicides, the chemistry of new insecticides and fungicides, and methods of manufacturing insecticides and fungicides, they are made the subject of investigative study.

Cooperation.—Bureau of Chemistry.

Location.—Washington, D. C.

Date begun.—1910.

Results.—New chemical methods of examining many insecticidal and fungicidal materials have been evolved, standards for certain insecticides and fungicides have been tentatively adopted on the basis of this work, the chemical properties of insecticides and fungicides have been investigated, and manufacturers have received suggestions relative to methods of manufacturing insecticides and fungicides. Publication: "Electrolytic Separation of Zinc, Copper, and Iron from Arsenic." Article completed but not published: "The Preparation and Properties of the Arsenates of Lead and Lead Chlorarsenate (Artificial Mimetite)."

Assignment.—J. K. Haywood, chairman of board; C. C. McDonnell.

Proposed expenditures, 1915–16.—$4,000.

Investigations of the Efficacy of Fungicides and Action of Fungicides and Insecticides on Vegetation:

Object.—To obtain basic information necessary in the enforcement of the insecticide act relative to action of fungicidal materials on fungi, improve methods of testing fungicides, and secure data relative to the action of fungicides and insecticides and insecticidal and fungicidal materials on vegetation.

Procedure.—As new questions arise relative to the activity or nonactivity of fungicides and fungicidal materials and the action of fungicides, insecticides, and insecticidal and fungicidal materials on vegetation, these are made the subject of investigative study.

Cooperation.—Bureaus of Plant Industry, Entomology, and Chemistry.

Investigations of the Efficacy of Fungicides and Action of Fungicides and Insecticides on Vegetation—Continued.

Location.—Washington, D. C.; Arlington, Va.; and leased orchards and truck patches.

Date begun.—1910.

Results.—The activity or nonactivity against fungi of a number of substances determined; action of a number of groups of insecticides and fungicides on vegetation also determined and general conclusions drawn relative thereto; results used in correspondence and in the enforcement of the insecticide act.

Assignment.—M. B. Waite, member of board; Errett Wallace.

Proposed expenditures, 1915–16.—$800.

Investigations of the Efficacy of Insecticides and Action of Same on Vegetation:

Object.—To obtain information relative to the action of insecticides and insecticidal materials on insects, as necessary in the enforcement of the insecticide act; to improve methods of testing insecticides; and to secure data relative to the action of insecticides and insecticidal materials on vegetation.

Procedure.—As new questions arise relative to the activity or nonactivity of insecticides and insecticidal materials and the action of same on vegetation, these are made the subject of investigative study.

Cooperation.—Bureaus of Entomology, Plant Industry, and Chemistry.

Location.—Washington, D. C., and Vienna, Va.

Date begun.—1910.

Results.—The activity or nonactivity against various insects of a large number of substnaces determined; action of a number of insecticidal substances on vegetation also determined and general conclusions drawn relative thereto; results used in the enforcement of the insecticide act and in correspondence.

Assignment.—A. L. Quaintance, member of board; E. W. Scott.

Proposed expenditures, 1915–16.—$1,500.

Chemical, Bacteriological, and Toxicological Investigation of Insecticides and Fungicides Used Primarily on Horses, Cattle, Sheep, Swine, or Goats, and Efficacy Tests of Same:

Object.—To obtain basic information relative to these insecticides and fungicides and of materials used in their preparation, which is necessary in the enforcement of the insecticide act; to improve methods of examining and testing such insecticides and fungicides; to secure data relative to the activity or nonactivity of substances used in such insecticides and fungicides; and to investigate the toxic action of such insecticides, fungicides, and materials which are used in their preparation.

Procedure.—As new questions arise relative to methods of analysis, the activity or nonactivity of certain substances used in insecticides and fungicides, the efficacy of certain insecticides and fungicides, and the toxic action of certain insecticides and fungicides and materials used in same, these are made the subject of investigative study.

Cooperation.—Bureau of Animal Industry.

Location.—Washington, D. C.

Date begun.—1910.

Results.—New methods of examining certain insecticides and fungicides have been evolved, the activity or nonactivity against insects and fungi of many substances determined, and the toxic properties of a number of substances ascertained; results used in the enforcement of the insecticide act and in correspondence.

Assignment.—J. A. Emery, member of board.

Proposed expenditures, 1915–16.—$600.

Total, Enforcement of the Insecticide Act, $100,000 (regulation, **$92,500**; research, $7,500).

FEDERAL HORTICULTURAL BOARD.

ENFORCEMENT OF THE PLANT QUARANTINE ACT.

Administration:

Object.—To carry on administrative and clerical work necessary for the proper conduct of the field covered by the plant quarantine act, namely, control of importation of nursery stock and other plant products, enforcement of foreign and domestic plant quarantines, and such investigation as may be necessitated by quarantine and other control measures.

Cooperation.—Related bureaus of the department, inspection officials of the several States, and inspection officials of foreign countries.

Location.—Washington, D. C.

Date begun.—1912.

Assignment.—C. L. Marlatt, chairman; R. C. Althouse, secretary.

Proposed expenditures, 1915–16.—$19,500 (regulation, $18,800; research, $700).

[Regulation.]

Control of Entry of Plants and Plant Products under Regulation:

Object.—To provide for foreign inspection and certification of nursery stock and other plants and plant products under regulation; to secure prompt notification of arrival and proposed distribution; and to provide for the proper inspection, either at port of entry or at place of destination, of such imports.

Procedure.—Issuance of permits; securing proper reports from importers and customs officials, and transmitting such reports in the case of nursery stock to State inspectors; keeping records of importations, and taking steps to maintain full compliance with the regulations on the part of inspectors in export countries as to proper certification and marking, and on the part of importers as to notification, examination, or disinfection at port of entry or at destination.

Cooperation.—State inspectors, customs officials, American consuls and postmasters, and inspectors in foreign countries.

Location.—Washington, D. C., and ports of entry concerned.

Date begun.—1912.

Results.—Regulations drawn covering all details and general compliance therewith being secured; marked improvement in condition of nursery stock and plant products imported.

Assignment—C. L. Marlatt.

Proposed expenditures, 1915–16.—$13,000.

Foreign Plant Quarantines:

Object.—To prevent, under existing quarantines, the entry of plant material affected with white-pine blister rust, potato wart, powdery scab of potato, Mexican fruit fly, avocado weevil, the pink bollworm of cotton, European pine-shoot moth, citrus canker, and other citrus diseases, *Sclerospora maydis* disease of Indian corn, and insect enemies and plant diseases of sugar cane; and to provide for like control by quarantine of any new danger that may arise.

Procedure.—Notification of hearing, conduct of hearing, promulgation of quarantine, and enforcement thereof through cooperation with State, Treasury, and Post Office Departments, State inspectors, and foreign inspectors.

Cooperation.—State inspectors, customs officials, American consuls and postmasters, and inspectors in foreign countries.

Location.—Washington, D. C., and ports of entry concerned.

Date begun.—1912.

Results.—Practical prohibition effected of articles covered; exceptional instances of entry followed up and goods destroyed.

Assignment.—C. L. Marlatt.

Proposed expenditures, 1915–16.—$2 000.

Domestic Plant Quarantines:

Object.—To prevent, under existing quarantines, further distribution within the United States of the Mediterranean fruit fly and melon fly, the gipsy moth and brown-tail moth, date-palm scale insects, the powdery scab of potato, the pink bollworm of cotton, and insect enemies and plant diseases of sugar cane; and by future quarantine to control any new pest that may appear.

Procedure.—Notification of hearing, conduct of hearing, promulgation of quarantine, and provision for enforcement of inspection, disinfection, and certification requirements.

Cooperation.—State commissioners of agriculture and horticulture, State inspectors, and postmasters, and particularly the Bureau of Entomology of this department.

Location.—Washington, D. C., with branch stations in districts particularly concerned by quarantines, including the New England States; Clinton and Franklin Counties, N. Y., and the eastern portion of Long Island; Webb County, Tex.; Yuma, Maricopa, and Pinal Counties, Ariz.; Riverside and Imperial Counties, Cal.; and Porto Rico and Hawaii.

Date begun.—1912.

Results.—These quarantines are now in full operation, with fairly adequate inspection service, and the further spread of the pests enumerated under "Object" is either entirely prevented or greatly retarded.

Assignment.—C. L. Marlatt.

Proposed expenditure, 1915–16.—$10,500.

Inspection and Certification of Potatoes for Interstate Shipment from Areas Quarantined for Powdery Scab:

Object.—To prevent the movement of diseased potatoes from quarantined areas.

Procedure.—Under the revised regulations of March 27, 1915, as a condition of shipment, potatoes are required to be freed by shippers from powdery scab and diseases similar to powdery scab in appearance. Compliance with this condition is determined (1) by a preliminary examination made of the potatoes at fixed points en route, and (2) by such subsequent examination as may be possible and necessary at destination of shipments. Provision is made for racking and freeing of shipments from infected potatoes at point of preliminary examination and at destination.

Cooperation.—The proper officials of the States concerned, both as to States of export and States of destination.

Location.—Washington, D. C., with branch stations at Portland, Me., Bluff Point, N. Y., and Alburg, Vt., the latter to cover potatoes shipped from Clinton and Franklin Counties, N. Y., over the Rutland Railroad.

Date begun.—1914.

Results.—Further spread of the disease has been materially checked.

Assignment.—W. Blair Clark.

Proposed expenditures, 1915–16.—$75,000, plus unexpended balance, if any, of $25,000 made immediately available.

[Research.]

Plant Quarantine Investigations:

Object.—Investigation of insect and plant-disease conditions as a basis for needed quarantine action.

Procedure.—When it is brought to the attention of the Federal Horticultural Board that a dangerous plant pest liable to be imported into the United States occurs in some foreign country or has already obtained a limited foothold in the United States, if the additional information needed before intelligent quarantine action can be taken can not be promptly furnished by the bureau of the department concerned, qualified experts are detailed to make the necessary studies and investigations.

Cooperation.—Various bureaus in the Department of Agriculture, other scientific bureaus of the Government, the related officials of the several States, foreign officials and experts, and associations or individuals concerned.

Plant Quarantine Investigations—Continued.

Location.—Limited so far to Mexico, on account of the Mexican orange worm; the Mediterranean region, on account of the Mediterranean fruit fly; Canada; Holland, Belgium, Germany, and other European countries; and the Atlantic Coast and Gulf States, New York, Ohio, Indiana, Illinois, Wisconsin, and Idaho, on account of powdery scab of potatoes; Territory of Hawaii, on account of the pink bollworm of cotton.

Results.—Valuable information has been gained in regard to the lemon and other fruits of Mediterranean countries as affected by the Mediterranean fruit fly; necessity for the quarantine against certain Mexican fruits on account of the Mexican fruit fly has been confirmed; determination of the distribution of powdery scab and other potato diseases in Europe, the Dominion of Canada, in Maine, and in Clinton and Franklin Counties, N. Y., and surveys of other States on account of this disease.

Assignment.—C. L. Marlatt.

Proposed expenditures, 1915–16.—$5,000.

Total, Federal Horticultural Board, $125,000 (regulation, $119,300; research, $5,700), plus unexpended balance of $25,000 made immediately available for domestic potato quarantine.

LIVE-STOCK PRODUCTION IN CANE-SUGAR AND COTTON DISTRICTS.

[Research.]

Experiments in Live-Stock Production in Cane-Sugar and Cotton Districts:

Object.—To determine the best methods of producing live stock on a commercial scale in the cane-sugar and cotton districts.

Procedure.—For the purpose of conducting experimental work to determine the cost of producing different kinds of live stock, a farm between New Iberia and Jeanerette, La., consisting of 500 acres, has been divided into four subdivisions or small farms, one devoted to the production and finishing of beef cattle, one to the production of hogs, another to dairy cattle, and a fourth to the production of mules and to the feeding of the work animals on the farm. These farms are to be kept entirely distinct in every respect. It is planned to utilize to the greatest possible extent pasturage, supplemented with crops to be grazed off by the animals, using the minimum amount of purchased feed or feed from the barns.

It is proposed to establish crop rotations and to determine what methods of handling the animals will be most economical, dealing with animals in rather large numbers. All the knowledge available about the production of crops and the feeding of animals will be applied on these farms for the purpose of making a definite determination of the commercial possibilities of live-stock production in that region.

Cooperation.—Work organized and undertaken cooperatively by the Department of Agriculture and the Louisiana Experiment Station.

Location.—New Iberia, La.

Date begun.—1914.

Results.—The farm has been laid off in pastures and plats for various forage crops. The pastures have been seeded to various grasses and clovers, and crops in the various rotations are being planted in their proper season. Fences have been erected and two barns, a tool shed, a well house, and a small cottage built. The work stock for the place includes mares and mules. The mares will be used for breeding purposes. Two carloads of steers were fed on cane tops and whole cane, and these animals have been sold.

Assignment.—These investigations are under the supervision of the following committee appointed by the Secretary of Agriculture: W. A. Taylor, chief of the Bureau of Plant Industry, B. H. Rawl, chief of the Dairy Division, Bureau of Animal Industry, and W. R. Dodson, director of the Louisiana Experiment Station, Baton Rouge, La. C. E. Mauldin, of the Bureau of Animal Industry, has immediate charge of all the work of the station but is directly responsible to the committee.

Proposed expenditures, 1915–16.—$47,500.

[Extension.]

Live-Stock Extension Work in Louisiana:

Object.—To disseminate information relative to the best methods to be used in producing live stock in the cane-sugar and cotton districts of Louisiana. The lines to be covered will include beef cattle, hogs, horses, and mules, poultry, dairying, and forage crops.

Procedure.—The best information now available regarding live-stock production will be disseminated among the farmers, through demonstrations and in other ways, by live-stock specialists. Later, when the results of the experiments conducted on the live-stock farm at New Iberia become available, this information will be carried to the farmers in a similar manner.

Live-Stock Extension Work in Louisiana—Continued.

Cooperation.—This work is organized and directed cooperatively by the Department of Agriculture and the extension department of the Louisiana State University.

Location.—Throughout the cane-sugar and cotton districts of Louisiana.

Date begun.—1914.

Results.—It is yet too early to report any very definite results. Live-stock and poultry demonstrations have been organized in connection with county agents to the extent of the facilities of the small corps of men now engaged in this work. Incidentally, whenever possible, other assistance has been given to promote live-stock production, such as taking part in public meetings, locating animals for breeding purposes, etc.

Assignment.—G. E. Nesom, leader of live-stock extension work, under the direction of W. R. Dodson.

Proposed expenditures, 1915–16.—$12,500.

Total, Live-Stock Production in Cane-Sugar and Cotton Districts, $60,000 (research, $47,500; extension, $12,500).

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